AGRICULTURAL ENGINEERING

JULY • 1951

Effect of Installation Practices on Draintile Loading *J. van Schilfgaarde, R. K. Frevert*

Special Structures for the Self-Feeding of Hay and Ensilage *Charles H. Reed*

A Graphic Method of Finding the Depth of Irrigation Water Applied *James E. Garton*

The Basic Need in the Dairy Stable Ventilation Problem *Clesson N. Turner*

Research Results in Drying and Storing of Flaxseed *J. W. Sorenson, Jr., W. G. Davenport*

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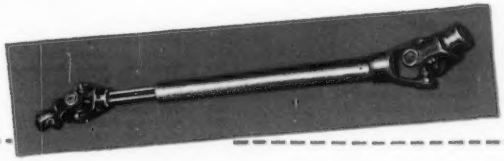

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AGRICULTURAL ENGINEERING

Established 1920

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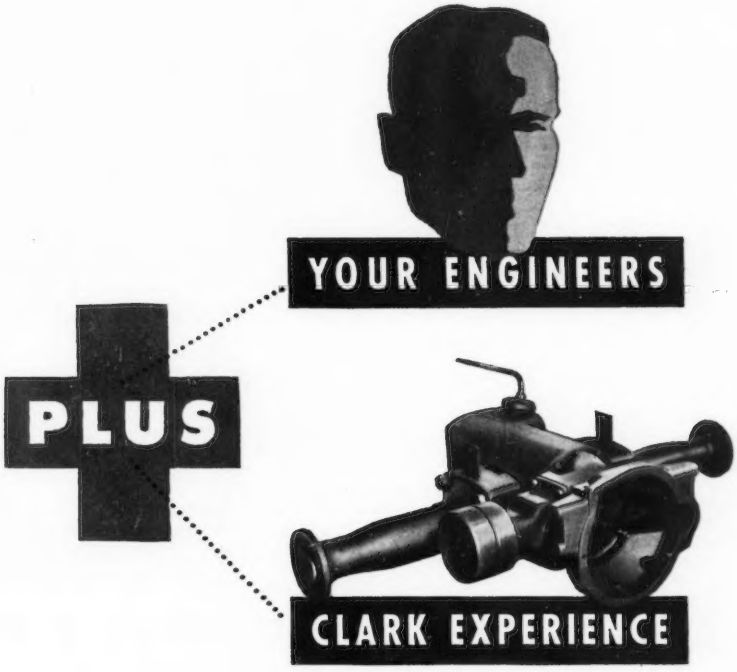

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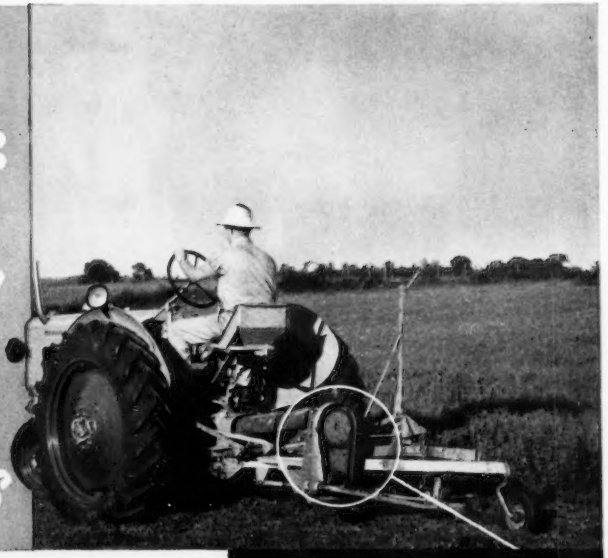
The MM UNI-MOWER: quality engineered for better mowing jobs



Imaginative engineering makes the Uni-Mower an outstanding product in the MM line of hay tools. Designed for easy attaching and detaching, the Uni-Mower can be mounted on any modern tractor with a power take-off for fast, clean mowing.

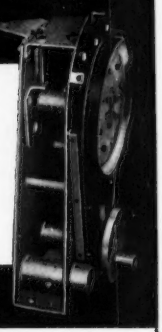
From an engineering viewpoint, the Uni-Mower features the elimination of excess weight, and an important reduction in moving parts, with a resulting decrease in maintenance.

Power transmission has been improved and simplified by the V-belt drive, which is powered by the take-off shaft, equipped with a high-quality universal joint assembly. This drive eliminates gearing for smoother, quieter operation, and allows slippage in the event of slugging or stoppage—thereby preventing breakage of other parts. The entire unit is protected from damage by a safety spring release which automatically allows the sickle bar and mower to pivot and by-pass obstructions in the field.

Ease of operation stems from the conveniently located foot pedals and hand levers for lifting and lowering the sickle-bar—and the Uni-Mower's clean, open design makes all parts easily accessible to the farmer.

SIMPLIFIED V-BELT POWER TRANSMISSION

This consists of a V-belt pulley, driven by the power take-off shaft—the quiet, smooth-running DURKEE-ATWOOD V-Belt—and a V-belt pulley that is an integral part of the Pitman fly wheel. You get quieter, smoother operation . . . no gears to adjust and fewer wearing parts to break and replace.



DURKEE-ATWOOD AGRICULTURAL V-BELTS:
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Minneapolis-Moline buys a large share of their belt requirements for the Uni-Mower (and many other belts) from DURKEE-ATWOOD, because they measure up to MM's standards of quality. In specifying integral parts for the Uni-Mower, MM engineers selected DURKEE-ATWOOD V-Belts after exhaustive tests in field and laboratory.

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DA PRODUCTS

Form No. 519

Unretouched photo of horse trailer after nine years of constant use, showing excellent condition of the Exterior-type Douglas fir plywood. Man closing the endgate is Paul Rutland, Oregon State College experimental aid in the animal husbandry department.

Exterior-type Douglas fir plywood gives this horse trailer an ideal combination of strength, rigidity, durability, and light weight. Sides are ½" Exterior plywood; front is ¼" plywood with face grain placed vertically to facilitate bending around framework; endgate is a ½" panel attached to five 2x3 studs. Floor of the trailer is also of ½" Exterior plywood over a solid 3" subfloor. Completed trailer weighs about 850 pounds and is so balanced that it can be maneuvered easily by one man. Complete building instructions are contained in Circular of Information 482, available free from Agricultural Engineering Department, Oregon State College, Corvallis, Oregon.

Plywood Horse Trailer at Oregon State College "Very Satisfactory; Durable, Tough and Strong"

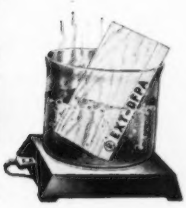
THE VERSATILITY of Exterior-type Douglas fir plywood as an all-around farm construction material is once again demonstrated in this single-horse trailer built at the Department of Agricultural Engineering, Oregon State College.

"The trailer has really been given a rough time since being built in 1942," according to Paul Rutland, animal husbandry department experimental aid. It has been in constant use in experiment station work, transporting all kinds of livestock—bulls, cows, sheep and hogs, as well as horses. For the first four years, the trailer was not even painted; it was given only a linseed oil finish when built. In 1946 it received its one paint job. Rutland, and Joe Johnson, assistant professor of animal husbandry at the college, both state the trailer to be "very satisfactory; durable, tough and strong."

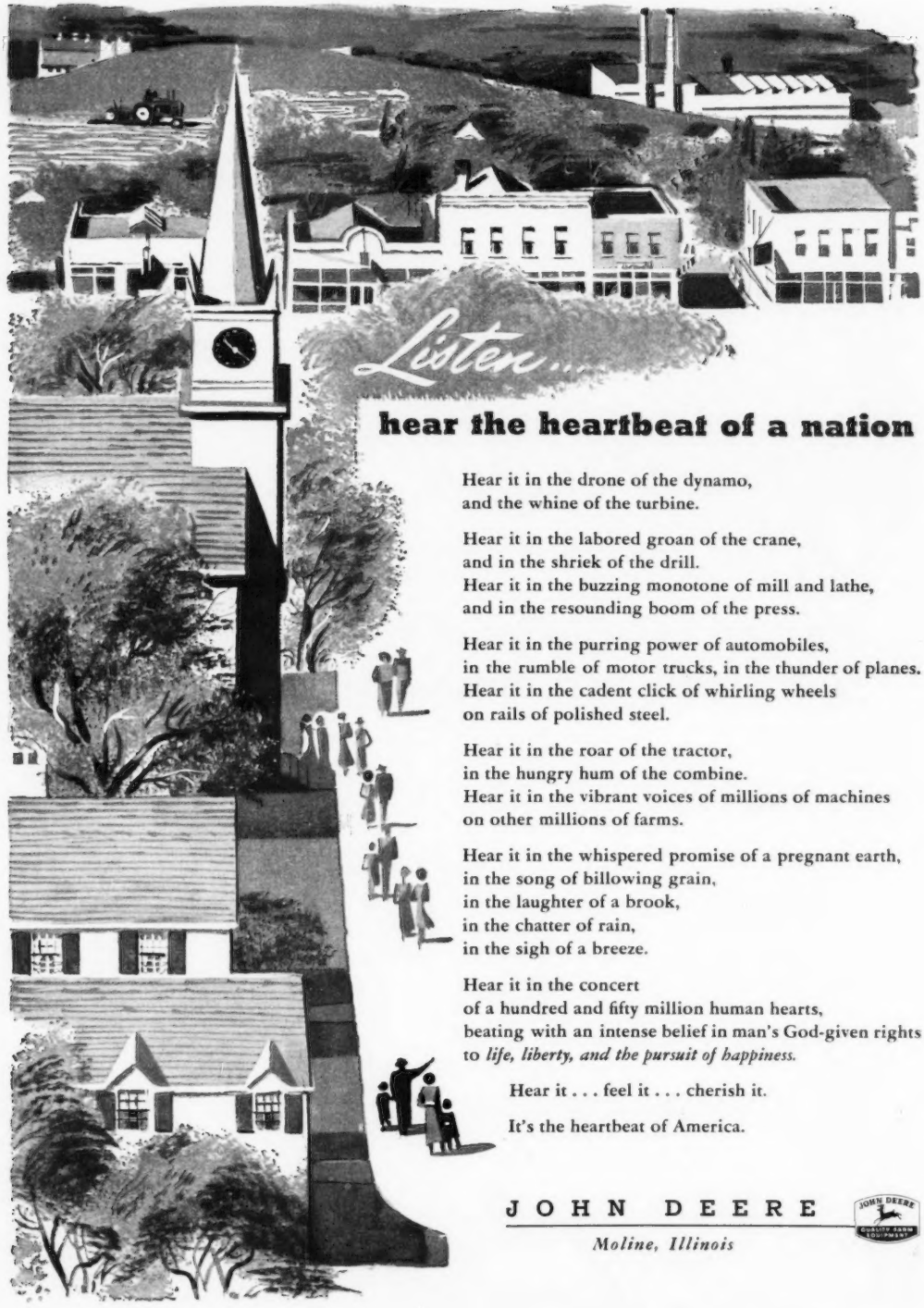
Building instructions are available from Oregon State College; see address above.

Exterior-Type
Douglas Fir
Plywood

Can Be Boiled In Water—
A Test Far More Severe
Than Years of Weathering!



Also available: 32-page booklet "Better Farm Buildings With Exterior Plywood" containing sections on grain bins, silos, poultry houses, hog houses, dairy barns, and other service buildings, on farm home construction and remodeling. For your copy (mailed anywhere in the U. S.) write Douglas Fir Plywood Association, Tacoma 2, Washington. Field Offices: 848 Daily News Building, Chicago 6; 1232 Shoreham Building, Washington 5, D. C.; 500 Fifth Avenue, New York City 18.



hear the heartbeat of a nation

Hear it in the drone of the dynamo,
and the whine of the turbine.

Hear it in the labored groan of the crane,
and in the shriek of the drill.
Hear it in the buzzing monotone of mill and lathe,
and in the resounding boom of the press.

Hear it in the purring power of automobiles,
in the rumble of motor trucks, in the thunder of planes.
Hear it in the cadent click of whirling wheels
on rails of polished steel.

Hear it in the roar of the tractor,
in the hungry hum of the combine.
Hear it in the vibrant voices of millions of machines
on other millions of farms.

Hear it in the whispered promise of a pregnant earth,
in the song of billowing grain,
in the laughter of a brook,
in the chatter of rain,
in the sigh of a breeze.

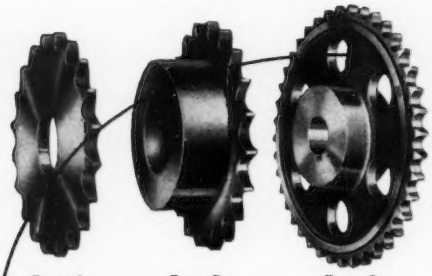
Hear it in the concert
of a hundred and fifty million human hearts,
beating with an intense belief in man's God-given rights
to *life, liberty, and the pursuit of happiness.*

Hear it . . . feel it . . . cherish it.

It's the heartbeat of America.

JOHN DEERE

Moline, Illinois



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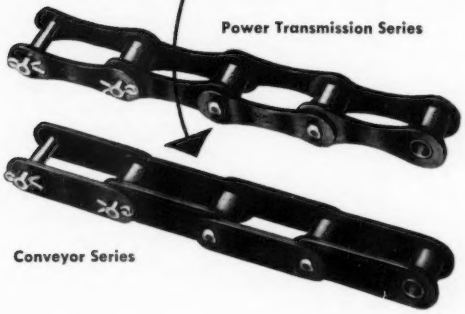

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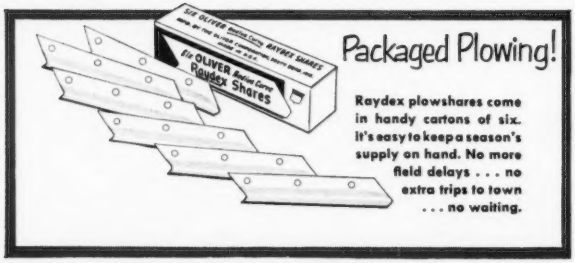

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When we returned to the office we thought of answering Mr. Richards' question in another, and perhaps more explicit way . . . by showing him a list of whom we serve. "Well," he exclaimed, "You must be good or you wouldn't have so many famous and discriminating customers on your books." We agreed with his deduction as you may, too, when you glance over the random list below.

Naturally, we've been mighty proud to do business with so many of the leaders of American industry during our 35 years. We regard such patronage as a vote of confidence too priceless ever to jeopardize. And it would seem that YOU could rightfully regard it as complete evidence of our ability and capacity to satisfactorily serve YOUR Company. Aetna Ball and Roller Bearing Company, 4600 Schubert Avenue, Chicago 39, Illinois.

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ALUMINUM GOES TO SCHOOL -

Reynolds Farm Institute begins a series of research projects and field tests.

A primary purpose of Reynolds Farm Institute is to provide reliable and unbiased information through cooperative research projects with agricultural colleges and universities. These projects are set up as cooperative ventures designed to bring together the knowledge of manufacturers and research institutions to obtain facts relating to the advantages of aluminum in any specific use or application.

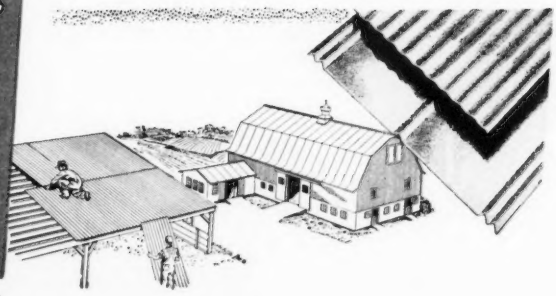
Most of the experiments concern the effect of aluminum's radiant heat reflectivity on livestock and poultry production. Shade research on animal shelters continues in areas where intense heat retards production. Aluminum dairy barns are being studied in regions where climatic conditions dictate variations of construction and management. In the field of poultry, where aluminum has already proved an important aid to production, tests are continuing in principal poultry producing areas. Increased interest in better rural housing prompts Farm Institute research in this important field.

The benefit of summer heat reduction in aluminum structures is also being tested for grain storage. The converse of this — winter heat retention, and consequent fuel saving — is being proved in tobacco-curing tests, using aluminum-lined structures. Fruit growing is another category on the planned list — testing aluminum for picking sheds and for its insulating value in storage.

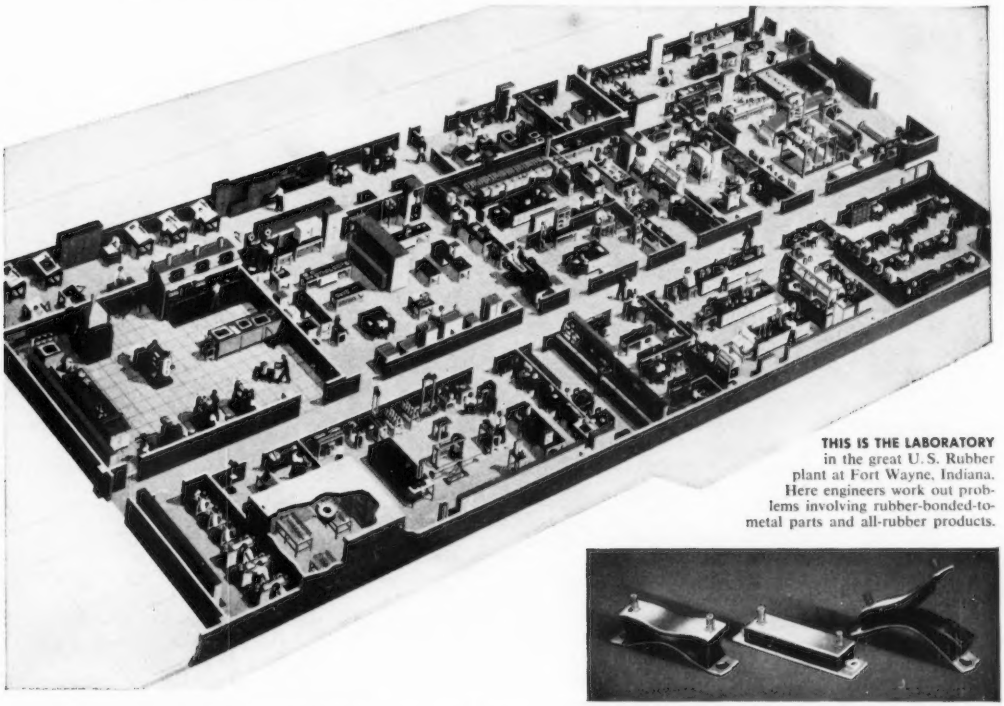
The benefits indicated by these projects are entirely apart from the structural advantages of light, strong aluminum, and the reduction in building maintenance cost through aluminum's rust-proof permanence. Reports will be made as test results are recorded.

REYNOLDS FARM INSTITUTE

These areas are covered by active Farm Institute projects.



What's U.S. Rubber doing to make mechanical equipment more efficient?



THIS IS THE LABORATORY in the great U. S. Rubber plant at Fort Wayne, Indiana. Here engineers work out problems involving rubber-bonded-to-metal parts and all-rubber products.

RESULTS OF TESTS showing strength of Adhesion to Metal in U. S. Rubber Mountings. The mounting in the middle shows the original shape of the 2 adjacent mountings which have been "pulled" in a lab test. Note how the metal was badly bent before the adhesion failed. The D-nuts were actually torn out by the testing machine.

In the great "U. S." laboratory at Fort Wayne, "U. S." technicians are constantly studying problems involving all types of mechanical equipment with moving parts. Among their long list of successes are U.S. Rubber Mountings, which isolate vibration, absorb impact and reduce transmitted noise on motor cars, trucks and industrial equipment.

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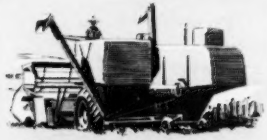

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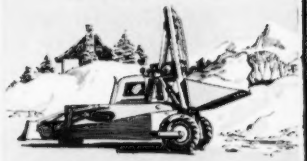

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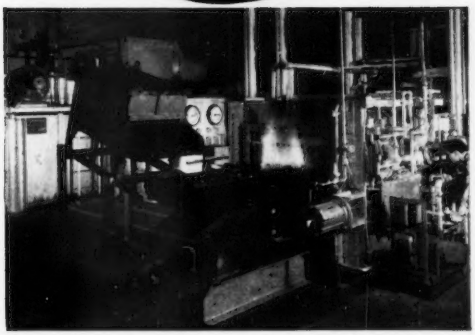

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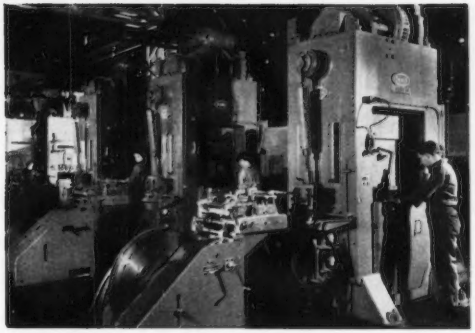

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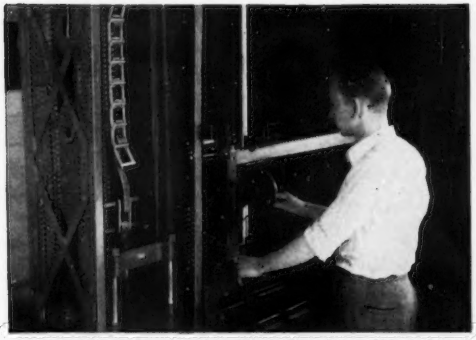

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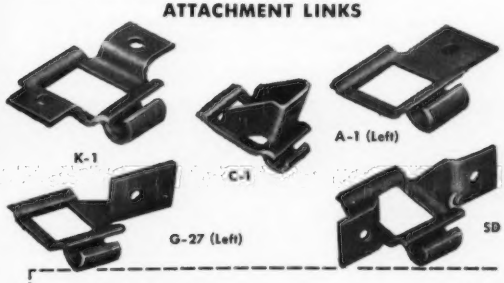

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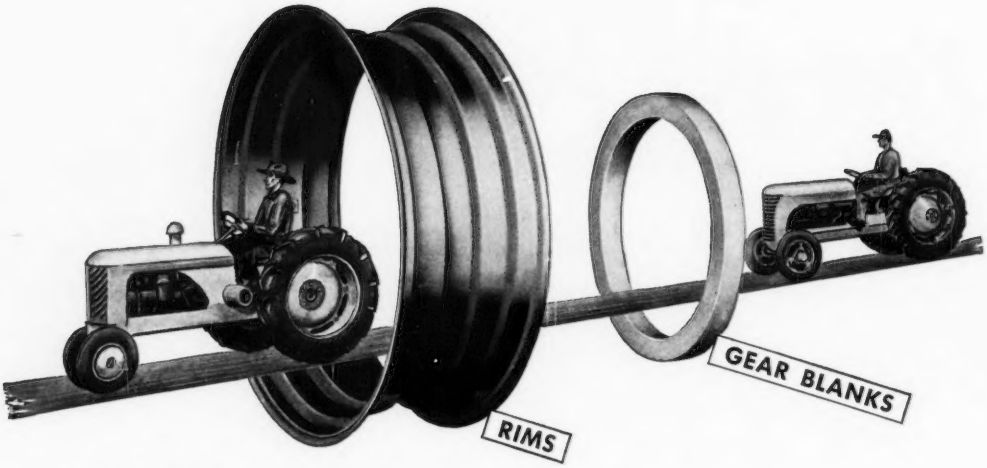

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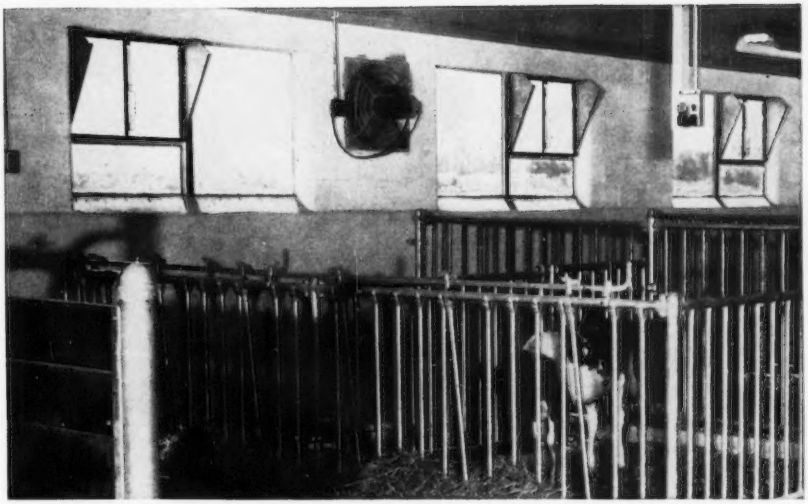

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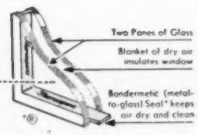

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EDITORIAL

Engineered Farm Safety

IT HAS become a nationwide custom, in the heat of July, to invest some time in a special consideration of farm safety. Perhaps in scheduling Farm Safety Week for July 22-28 this year, the National Safety Council recognized it as a time when the lessons of farm safety might sink in, in terms of the added vacations, diversions, and relaxation which might be enjoyed with the time, money, and misery we still waste in tribute to farm accidents.

In the slow sequence of human progress we have reached the stage of appreciating that most accidents are avoidable, and the further stage of knowing specific measures which can be taken to avoid many of them. Many of us have not yet reached the stage of practicing regularly and systematically more than a few of those safety measures which we know to be to our own best interests.

From an engineering standpoint most accidents can be attributed to human responses to physical conditions.

That definition has suggested two well-known and effective approaches to accident prevention. Human responses can be changed, to a degree, by education. Further, man can change and control his environment, to a degree, to increase the range of safe action which it permits.

Agricultural engineers have definite responsibilities in both of these approaches to safety in farm life and work.

On the educational side, it is true that much of the safety subject matter to be taught to farmers involves simple good housekeeping and common-sense practices which represent no special technical monopoly or obligation of agricultural engineers. Beyond these fundamentals, however, there is an apparent opportunity for the development and teaching of safe practices based on technical engineering analysis of the physical factors encountered in farm life and work.

These include the age-old force of gravity which has been taking its toll among farmers ever since farming was first practiced as an occupation.

They include the physical characteristics, capacities, and limitations of the human body as a mechanism. The farmer and his family, as the physical entities for which protection from accidents is most important, have not yet been adequately analyzed as free-moving bodies regularly subject to destructive or damaging contact with total forces and concentrations of force far beyond the limits of their structural strength. His own body has not yet been adequately interpreted to the farmer as the accident factor most directly subject to his control.

The basic materials with which farmers live and work — soil, water, ice, crops, livestock, dusts, sprays, fertilizers, and explosives — are physical factors warranting further technical engineering analysis and non-technical interpretation to farmers as items involving great or small hazard depending largely on the farmers' methods of dealing with them.

Machines, structures, and electricity are the agricultural engineers' special contributions to farm accident hazards. To the credit of these items it should be acknowledged that they have reduced other accident hazards; that they have generally proven their worth over and above all costs, including a charge for calculated risk; and that they could be used much more safely than they are in common practice. The latter point is a special challenge to agricultural engineers in the matter of safety education.

One limitation of the educational approach is that, regardless of how safety-minded he may become, there are many times in his work when a farmer can give only a minimum of conscious attention to safety. If he is to succeed as a farmer, he must also give a lot of attention to the nature and effectiveness of his work output, and to many other things. He cannot pilot his farm from the safety of a rocking chair.

This emphasizes the importance of the "safe environment" approach. It means that we must not be satisfied to show farmers how, with eternal vigilance, they might work their way safely through a maze of hazards. As many hazards as feasible should be eliminated from the farm environment by design, so that farmers can give adequate attention to the remaining hazards which cannot be eliminated, and to the main purposes of their activities. The vigilance required of farmers should be matched by vigilance on the part of engineers.

Much good design work to reduce farm accident hazards has already been done by agricultural engineers in the farm power and machinery, farm structures, and rural electrification fields. Accidents continue at a rate which shows that more needs to be done.

Types of farm accident hazards, and of measures by which they may be prevented in design, construction, and farm operations are already well catalogued. There is apparent opportunity to further farm safety by more detailed engineering analysis of the physical factors contributing to farm accidents. It should show the way to added possibilities for designing hazards out of the farm environment, and for improving the effectiveness of safety education applied to those hazards which cannot be quickly eliminated by design.

Both the educational and environmental design approaches, based on sound engineering, have much to contribute to farm safety.

States of Mind

IN RECENT reflection on indications of agricultural engineering progress over the years, we noted some which are primarily states of mind rather than physical products, data, methods or practices. They seem worth nothing as intangibles which may easily be overlooked in measuring progress and in considering means to further progress.

There has been a notable increase in acceptance of the idea that agriculture is a field of human activity to which engineering technology can be applied effectively and in the interest of all concerned.

A related concept which has taken root and found nourishment in fact is the idea that agriculture is sufficiently specialized in its engineering requirements to warrant the development and services of a specialized branch of engineering.

Among agricultural engineers themselves there has been apparent progress in outlook on the nature of their work and opportunities. There has been a spread of recognition that agricultural engineering involves continual effort to further clarify the biological, economic, and social objectives to be served; and continued refinement of engineering approach to the service of those objectives.

The professional outlook on cooperation among agricultural engineers, and between them and other groups, in the interest of technical and professional progress, has spread with the increase of agricultural engineers in numbers and experience.

Development of these concepts has paralleled progress in the technology and practice of agricultural engineering. It is impracticable to attempt to assess the extent to which one might have been either the cause or the result of another. They are interrelated phases of significant progress in the over-all development of agricultural engineering.

These ideas were cultivated from their most delicate seedling stage to their present healthy vitality by the individual and collective efforts of pioneers. They were men who dared to dream of agricultural engineering; to think in terms of fundamental relationships; to work for professional progress, understanding and cooperation as an aid to technical progress.

They have fostered in agriculture and related activities a state of mind favorable to the employment of agricultural engineers. They have developed and exemplified the state of mind on the part of agricultural engineers which is conducive to effective service. It is for the enlarged present group of agricultural engineers to make the most of this intangible but valuable heritage.

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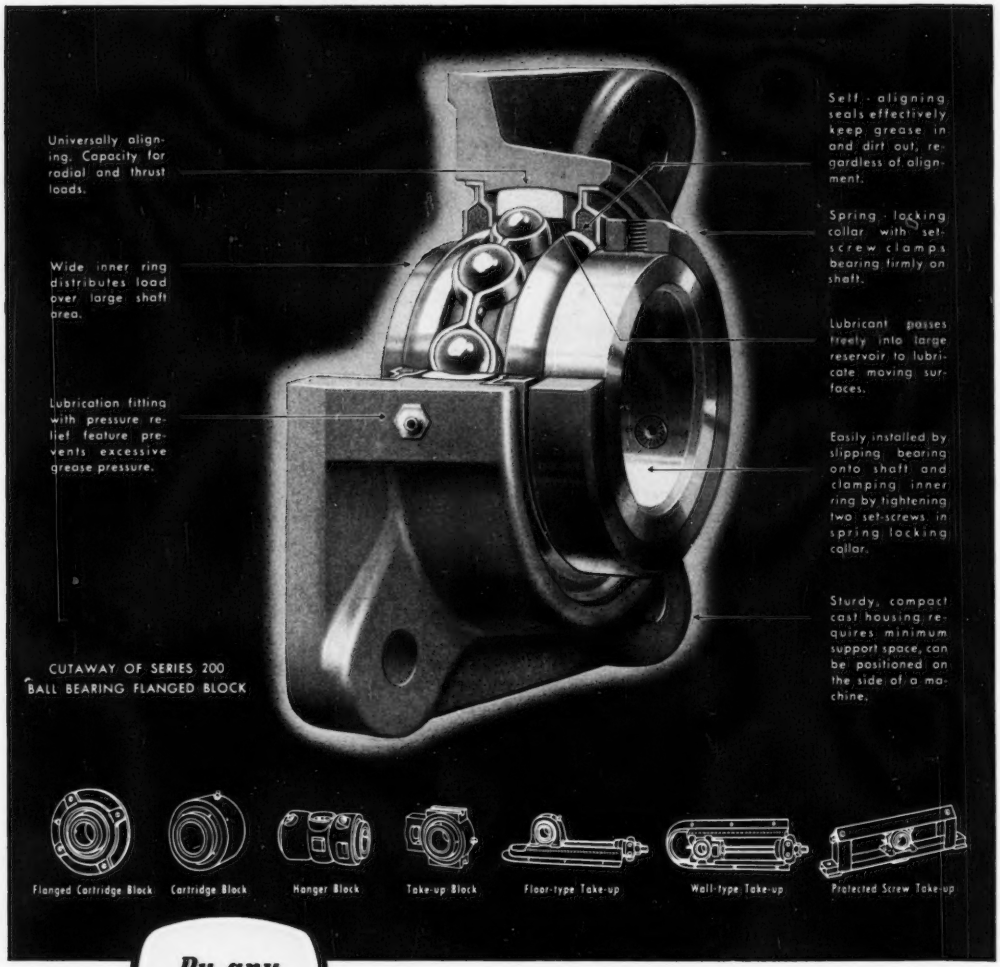
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AGRICULTURAL ENGINEERING

VOL. 32 JULY, 1951 NO. 7

Effect of Present Installation Practices on Draintile Loading

By Jan van Schilfgaarde, R. K. Frevert and W. J. Schlick

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THE advance in mechanization together with the high prices for farm products in recent years has caused an increased interest in farm drainage. Areas that could not be drained economically in the past can now often be drained successfully by the use of modern trenching equipment. This use of machines has caused an increase in the depth at which tile can be installed and often results in the use of wider trenches in which to install the tile. Consequently draintile is likely to be subjected to greater loads now than was common in the past.

This paper deals with three aspects of the problem of tile loading. First, the Marston formulas for loads on underground conduits are presented so that they can be solved with a minimum of calculations. Secondly, some information is presented to show the probable loads to which tile may be subjected. The third aspect is the effect of bedding conditions on the supporting strength of the tile.

This paper was prepared expressly for AGRICULTURAL ENGINEERING and is contributed as Journal Paper No. J-1896 of the Iowa Agricultural Experiment Station. Project 1038. Sponsored by the Structural Clay Products Institute and the Iowa State College Research Foundation.

The authors: JAN VAN SCHILFGAARDE and R. K. FREVERT, respectively, research fellow and professor of agricultural engineering, and W. J. SCHLICK, professor of civil engineering, Iowa State College, Ames.

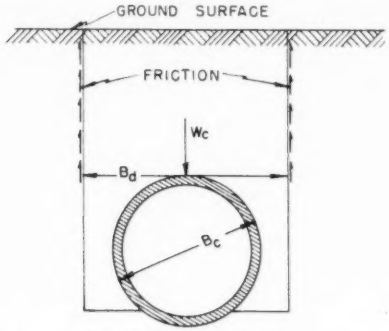


Fig. 1 Conduit in narrow ditch

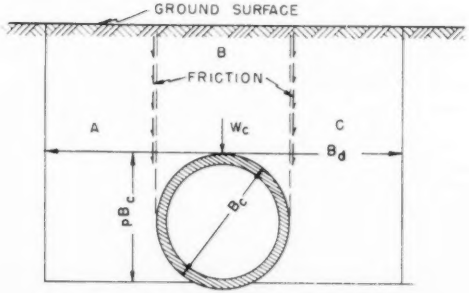


Fig. 2 Conduit in wide ditch

NOMOGRAPHIC SOLUTION OF CONDUIT LOAD FORMULAS

Conduit Load Formulas. In the case of rigid conduits installed in ditches of narrow width, the weight of the fill material will be partly carried by the conduit. The remainder of the weight will be absorbed by frictional forces between the sidewalls of the ditch and the fill material. These frictional forces develop as a result of the settlement of the prism of fill material with respect to the sides of the ditch (Fig. 1).

If a rigid conduit is installed in a ditch that is wide with respect to the size of the conduit, the weight of the fill material directly above the conduit (prism B, Fig. 2) will be carried by it, and, moreover, there will be frictional forces between this prism and the fill material to the sides of the conduit (prisms A and C) which exert a force on the conduit. In this case, these frictional forces act downward on prism B since the total settlement of the material to the sides of it exceeds the total deformation of the prism and the conduit itself.

The Marston theory (2, 3, 5, 6)* provides a formula for loads on pipes in narrow ditches, the "ditch conduit load formula". In its simplest form, this formula reads $W_c = C_d\, w\, B_d^2$, where W_c represents the load per unit length of conduit (pounds per linear foot), w the unit weight of the fill material (pounds per cubic foot), B_d the width of the ditch at the top of the conduit (feet), and C_d a coefficient. The second formula developed by Marston, the "projecting conduit load formula", was derived for conduits projecting above the embankment subgrade. It has been found experimentally (5), however, that it applies also to conduits in wide ditches. It can be written as $W_c = C_c\, w\, B_c^2$, where W_c and w are the same as before, B_c is the outer diameter

*Numbers in parentheses refer to the appended references.

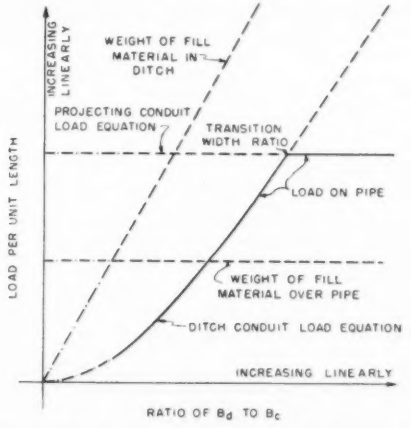


Fig. 3 Effect of increase in width of ditch on load on conduit

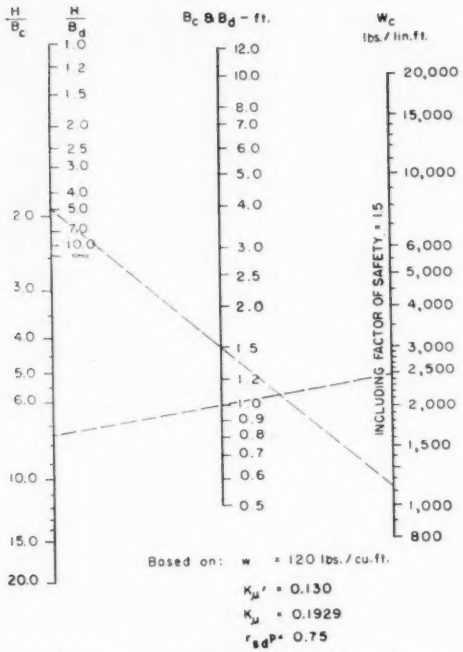


Fig. 4 Nomograph for loads on tile installed in thoroughly wet clay

of the conduit (feet), and C_c another coefficient. The coefficients C_d and C_c are functions of the frictional coefficients of the soil, the height of fill, and, respectively, the values of B_d and B_c. As these complex relationships have been discussed by others (6, 7) they are omitted here.

The manner in which a change in the width of ditch affects the load on a conduit, all other conditions remaining constant, is illustrated in Fig. 3. The formula for narrow ditches applies up to the point of intersection of the graphs of the two formulas, the one for wide ditches beyond this point. Although there probably is a transition zone between those widths which obviously are either wide or narrow, experiments (5) have indicated that one is justified in choosing that width at which the two formulas yield identical loads as the transition point.

Miller's Nomograph. The load formula for conduits in narrow ditches, in the past, applied to most drainage installations, i. e., to those cases in which the tile was installed by hand. This fact led Miller (4) to develop a nomograph on the basis of this formula. With the change in installation practices, however, the loading conditions have been changed so that now this formula does not always apply. Consequently, the loads as determined by means of Miller's nomograph are not always those which one would obtain from the Marston theory. Inspection of the above-mentioned graph (Fig. 3) shows that these loads may be considerably higher, but are always on the safe side.

Nomographs Applicable to All Drainage Installations. The nomographs presented here (Figs. 4, 5, 6,) are not restricted to loads on conduits in narrow ditches but apply to all rigid conduits, independent of the type of installation. There are three separate nomographs, prepared on the basis of three different soil types: thoroughly wet clay, saturated sand, and saturated top soil. These are the same conditions Miller used for his nomograph. The nomographs have been presented separately in order to facilitate their use. Each one enables the user to determine the load with either formula independently of the other and with a minimum of calculations. The lower value found in this manner is the one to be used in design. That the lower value obtained represents the load to be expected is apparent from inspection of Fig. 3. For widths less than the transition width, the formula for narrow ditches yields lower values for W_c; for greater widths, the formula for wide ditches yields lower values. The following example will illustrate the procedure:

A 10-in tile is installed 8.5 ft deep in an 18-in ditch in thoroughly wet clay. The first nomograph (Fig. 4) applies in this case. Use $B_c = 1.0$ ft, $B_d = 1.5$ ft and, for the height of fill above the tile, $H = 8.5 - 1.0 = 7.5$ ft. For $H/B_c = 7.5$ and $B_c = 1.0$, the nomograph gives $W_c = 2470$ lb per lin ft. For $H/B_d = 5$ and $B_d = 1.5$, $W_c = 1130$ lb per lin ft. The lower value is the one to be used. Therefore, the design load on the pipe is 1130 lb per lin ft.

In developing these nomographs from the Marston formulas, the following values were used for the various soil characteristics:

Soil type	w, lb/ft³	$K\mu'$	$K\mu$	$r_{sd}p$
Thoroughly wet clay	120	0.130	0.1924	0.75
Saturated sand	120	0.165	0.1924	0.75
Saturated top soil	110	0.150	0.1924	0.75

Here K is Rankine's constant

$$K = (\sqrt{\mu^2 + 1} - \mu) \div (\sqrt{\mu^2 + 1} + \mu),$$

μ' is the coefficient of friction between the fill material and the side of ditch, μ the coefficient of internal friction of the fill material, and $r_{sd}p$ a ratio depending on the projection ratio p (Fig. 2) and the "settlement-deflection ratio" r_{sd} (2).

DEPTH OF INSTALLATION

It is apparent that the strength of draintile required for satisfactory operation depends, among other factors, on the depth of installation. Therefore, a survey was conducted to determine the relative amounts of tile installed at various

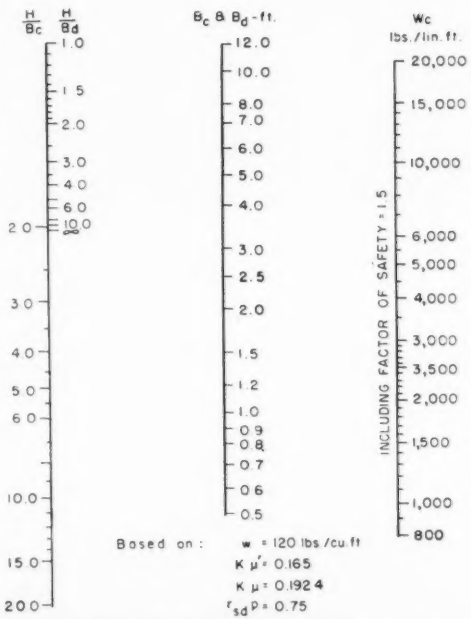


Fig. 5 Nomograph for loads on tile installed in saturated sand

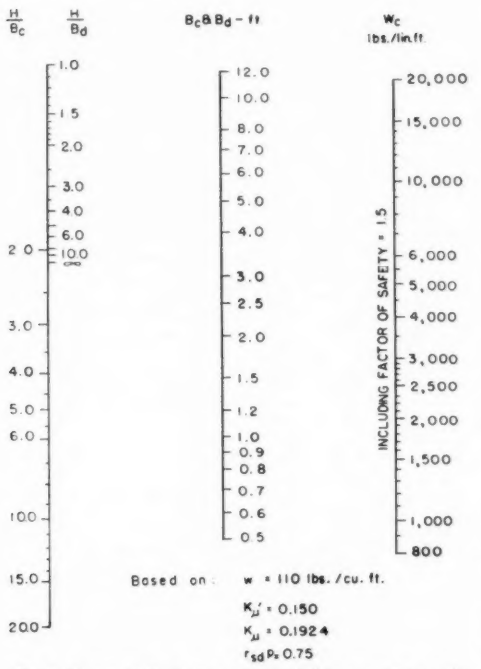


Fig. 6 Nomograph for loads on tile installed in saturated top soil

depths. Seven Iowa counties were arbitrarily chosen for the survey so that some, like Humboldt County, were in a geologically young glacial area of pocketed topography and others, like Henry County, in an older area where outlets are generally easier to secure. Only tile systems designed by and installed with the cooperation of the U. S. Soil Conservation Service were included in the survey.

The results of the survey showed that the majority of tile was installed at such depths that loads in excess of the minimum strength as specified by the ASTM † (1) are not likely to occur. However, the amount of tile installed at depths where excessive loading could occur was far from negligible. Because sufficient information was not available regarding the method of installation or the size of tile used, it was not possible to determine the percentage of the tile included in the survey which was subject to loads in excess of the minimum strength. Tables 1 and 2 show some of the results of the survey.

†The Standard Specifications for Draintile have since been revised (Des. C4-50T).

TABLE 1. DEPTH DISTRIBUTION OF TILE
(Feet)

Depth of cut, ft	Humboldt County	Hardin County	Floyd County	Black-hawk County	Marshall County	Henry County	Washington County	Total	Total per cent
0 - 2½	200	200			1,100	1,800	1,800	5,100	1.10
2½ - 3½	7,100	4,080	2,400	3,365	7,900	14,100	25,700	64,645	14.00
3½ - 4½	150,070	32,430	8,200	21,700	31,750	14,400	33,600	292,150	63.30
4½ - 5½	32,050	6,900	2,900	11,100	10,800	9,240	3,700	76,690	16.61
5½ - 6½	8,340	2,300	800	600	2,400	100	900	15,440	3.34
6½ - 7½	3,900	300						4,200	0.91
7½ - 8½	2,520							2,520	0.55
8½ - 9½	640							640	0.14
9½ and over	230							230	0.05
Total	205,050	46,210	14,300	36,765	53,950	39,640	65,700	461,615	100.0

TABLE 2. DEPTH DISTRIBUTION FOR VARIOUS TILE SIZES FOR HUMBOLDT COUNTY
(Feet)

Depth of cut, ft	5 & 6-in tile	8-in tile	10-in tile	12-in tile	14-in tile	16-in tile
0 - 3½	6,600	700				
3½ - 4½	143,490	5,880	700			
4½ - 5½	24,950	3,100	1,800	700	600	900
5½ - 6½	5,140	600	1,300	700	900	200
6½ - 7½	1,200	500	800	300	400	300
7½ - 8½	130	300	700	500	200	600
8½ - 9½	40		100		100	400
9½ and over	20			200		
Total	181,570	11,080	5,400	2,400	2,200	2,400

The wide differences between the depths encountered in the various districts can easily be explained by the topography of the area. In the swell and swale country, it is often necessary to cut through ridges to secure an outlet for low spots, whereas this is seldom the case in the older topography. It is emphasized that the survey was conducted in such a manner that the results did not lend themselves to a statistical analysis.

BEDDING CONDITIONS

That the load distribution affects the strength of a tile needs no amplification. The question arises, however, as to how much difference there is in the load distributions found in the field, and what effect the type of bedding has on this distribution.

To determine what bedding conditions are ordinarily encountered in the field, plaster casts were made of the bottoms of the trenches dug by a number of ditching machines (Fig. 7). A total of twelve casts were made. From these casts, symmetrized cross sections were drawn of the ditch bottoms (Fig. 8), and the outer circumference of a tile was superimposed on these cross sections. Both 5 and 10-in tile were used for this purpose.

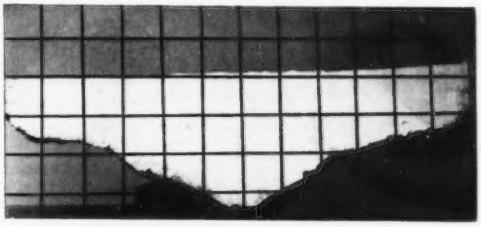


Fig. 7 Typical cast of trench bottom

The ratio of the actual field supporting strength of a tile to its three-edge bearing strength (6) is called the load factor. To compare the effects of the above beddings on the strength of tile, load factors had to be computed for each of the casts (7). For these calculations, a number of assumptions were made; no settlement of the tile takes place after installation; the vertical load W_c is uniformly distributed over the full width of the tile; the reaction of the trench bottom on the tile is concentrated as two line reactions at the center lines of the areas of contact between the tile and the trench bottom; the lateral pressure is distributed uniformly from the top of the tile to the point of application of the assumed concentrated reaction. The type of loading resulting from these assumptions is shown in Fig. 9.

Load factors were determined for both 5 and 10-in tile, with both zero lateral pressure ($q = 0$) and a total lateral pressure equal to one-fifth of the total vertical pressure ($q = 0.2$). By assuming the tile wall thickness to be one-tenth of the nominal diameter of the tile, the load factor can be expressed as a function of only two variables: α and q. Here α is defined as the acute angle between line of action and the vertical, and q as the ratio of the total horizontal pressure to total vertical pressure. This function is represented graphically in Fig. 10 for the two values of q used. The values of the function for the various casts have been tabulated in Table 3.

The analysis of the casts showed a variation in load factors from 0.9 to 2.5, with q ranging from 0 to 0.2. The ordinary bedding upon which the "ordinary field supporting strength" is based has a load factor of 1.5 (1). The ASTM specifications for draintile were originally expressed in terms of this ordinary field supporting strength.

Because of the simplifying assumptions, the calculated load factors will seldom be the same as those encountered in the field. In fact, the actual load factors will always be somewhat greater than these calculated values, because the assumption regarding concentrated line reactions implies an extreme condition. As long as there is not much settling after installation this assumption will not greatly affect the resulting values. Settlement would cause an increase in area of contact and consequently would result in a more nearly evenly distributed reaction. However, such settlement would not affect the angle α.

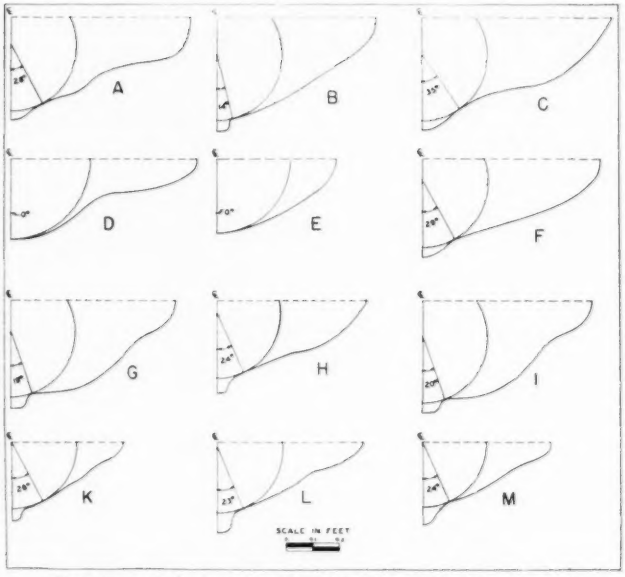


Fig. 8 Symmetrized cross sections of trench bottom with 5-in tile superimposed

TABLE 3. LOAD FACTORS FOR TWO RATIOS OF TOTAL LATERAL TO TOTAL VERTICAL PRESSURE

Cast	Angle α deg		Load factor			
			5-in tile		10-in tile	
	5-in tile	10-in tile	$q = 0$*	$q = 0.20$*	$q = 0$*	$q = 0.20$*
A	28	19	1.87	2.13	1.50	1.69
B	14	26	1.33	1.50	1.79	2.04
C	35	26	2.16	2.43	1.79	2.04
D	0	36	0.903	0.985	2.23	2.49
E	0	†	0.903	0.985	†	†
F	29	18	1.91	2.17	1.46	2.17
G	19	10	1.50	1.69	1.18	1.31
H	24	22	1.70	1.92	1.61	1.83
I	20	11	1.54	1.75	1.26	1.42
K	28	†	1.87	2.13	†	†
L	23	32	1.66	1.89	2.04	2.30
M	24	†	1.70	1.92	†	†

* q = ratio of total lateral to total vertical pressure.
† Ditch width insufficient for 10-in tile.

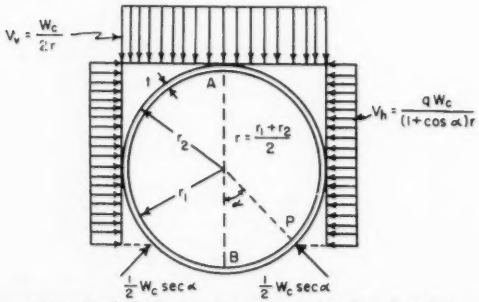


Fig. 9 Free-body diagram showing assumed loading of conduit

Even though the numerical values obtained from the above analysis do not yield the correct load factors, the curves (Fig. 10) give a basis for comparing the effectiveness of two beddings. Whereas q will generally be somewhat greater than zero, it will seldom exceed 0.2, *(Continued on page 378)*

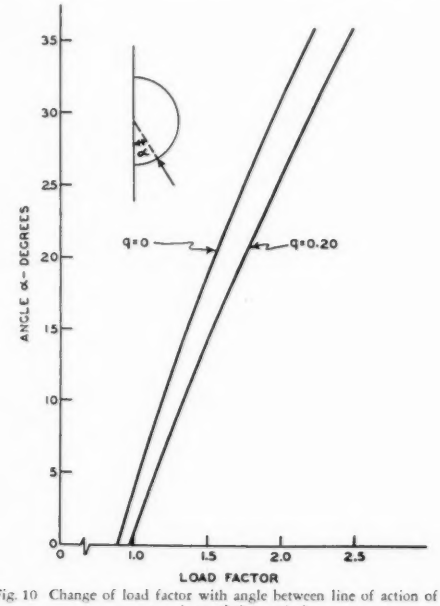


Fig. 10 Change of load factor with angle between line of action of the reaction and the vertical

Structures for Self-Feeding of Hay and Ensilage

By Charles H. Reed
MEMBER A.S.A.E.

A STUDY of self-feeders for hay was initiated by the New Jersey Agricultural Experiment Station in 1946*. Although more details must be determined before final plans are published, the results to date indicate that self-feeders for chopped hay can be recommended on farms where the operator is willing to make minor improvements. The cost of these improvements should not exceed the cost of labor saved as a result of self-feeding. It has not been determined whether the swinging gates of the type shown by Fig. 2 and illustrated in the first report are better than a less expensive rigid baffle now on trial.

Self-Feeders for Corn Silage. Trials with five self-feeder silos indicate that the basic design shown by Fig. 1 will self-feed corn silage. Results to date indicate that requirements for a satisfactory design are as follows: Maximum diameter is 14 ft and the maximum height is 45 ft. The fixed-end silo columns are designed to support the vertical load of all silage and the silo wall, in combination with the lateral outward pressure of the lower 5 ft of silage. Horizontal reinforcement in the base around the columns is not less than that required for the lower three feet of a conventional silo of similar diameter and height. Bearing plates are at the bottom of the columns. The silo is attached to the angle-iron hoop and columns to resist possible negative vertical pressures and wind pressures as in any conventional silo. The angle-iron hoop is designed to support the entire silo and silage load, and is attached to the columns in a manner to support the lateral thrust on the columns. The cone must support the entire silage load.

This paper was presented at the winter meeting of the American Society of Agricultural Engineers at Chicago, Ill., December, 1950, as a contribution of the Farm Structures Division. Approved as a paper of the Journal Series, New Jersey Agricultural Experiment Station, Rutgers University, the State University of New Jersey, Department of Agricultural Engineering.

The author: CHARLES H. REED, agricultural engineering department, Rutgers University, New Brunswick, N. J.

ACKNOWLEDGMENTS: The author is indebted to Richard S. Claycomb, (BPISAE), U.S. Department of Agriculture, for his cooperation in establishing the theory for the non-flow of grass silage over a cone. The New Jersey Agricultural Experiment Station is grateful to Paul M. Mazur, founder of the Paul M. Mazur Research Grant; to Z. W. Craine, of Craine, Inc.; to D. W. Ruedemann, Plainsboro (N.J.) dairy farmer, and to the Stran-Steel Div., Great Lakes Steel Corp., for their financial support and cooperation which have made possible more rapid progress in carrying out this project. We also are grateful to the farmers, institutions and commercial concerns who are experimenting at this time on various installations. Observations of these installations during the next feeding season will add greatly to our knowledge of the proper design for a self-feeding structure.

*The first published report on this project was published in AGRICULTURAL ENGINEERING, vol. 29, pp. 488-489 (November, 1948).

Self-Feeding Grass Silage. Ten self-feeder silos of the basic design described in the preceding paragraph and shown by Fig. 1 have been tested with grass silage. None have functioned satisfactorily.

In cooperation with Craine, Inc., Norwich, N. Y., a 16 x 30-ft self-feeder silo with a diameter three inches smaller at the top than at the bottom was constructed on the University Farm at New Brunswick. This silo was filled with soybean and sudan grass silage. A study was made of the packing and flow characteristics of this silage. It is believed that sufficient information about the internal stress characteristics of grass silage has been determined to design a silo base which will cause grass silage to self-feed satisfactorily and which will improve the function of self-feeders for corn silage. A trial of such a base will be made during the 1951-52 feeding season.

Reason for Non-Flow of Grass Silage Over a Cone. Grass silage is made by chopping grasses or legumes into lengths varying from ½ to 4 in and blowing it into the silo. Each particle of this chopped material comes to rest in a nearly horizontal plane and is crisscrossed with other particles in horizontal laminations. When the silo is filled, these laminations are subjected to a rather high pressure. Cattle can eat into the bottom of this silage mass as much as five feet, thereby reducing the area of support but greatly increasing the unit pressure on the silage column remaining. This remaining column of silage becomes so hard that cattle cannot gnaw it off. This high pressure on the horizontal laminations of silage results in a fibrous material approaching the tensile strength of wallboard used in the building trade. The tensile strength is sufficient to prevent a cone tip from punching up through the mass and splitting it, even if the coefficient of friction between the silage and the surface of the cone were zero. The resistance of the silage to being punched or split by the cone is similar to the resistance of a piece of paper to being forced over a smooth-pointed pencil.

Probably the only way to make the silage flow over a cone is to reduce the tensile strength of the laminated silage mass. This has been done with axes, saws, dynamite, and a pointed pole pushed horizontally by a bulldozer. It would be desirable to incorporate a device into the cone to do this job automatically. Possibly a stationary horizontal sharp knife placed to cut vertically would function if the resistance of the blade to penetration were not enough to support the silage mass. Other possibilities are a central duct or needle; a reciprocating knife or saw, which would make vertical cuts as the silage mass moved down; or stationary or movable partitions which would make a cleavage in the silage as the silo was filled.

(Continued on page 386)

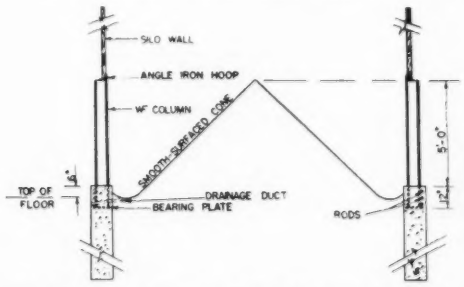


Fig. 1 Basic design of foundation for a self-feeder silo for corn silage described in this paper

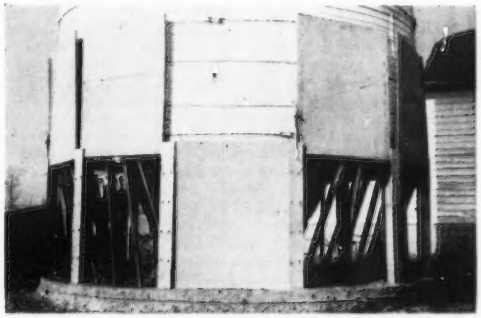


Fig. 2 This picture shows the panels and flexible gates on the self-feeder silo

A Graphic Method of Finding the Depth of Irrigation Water Applied

By James E. Garton
ASSOCIATE MEMBER A.S.A.E.

AGRICULTURAL engineers, extension workers, irrigation district operators, vocational-agriculture teachers, and sprinkler irrigation men are sometimes faced with a need for an easy method of explaining how to compute the depth of water an irrigation farmer is applying. A handy rule of thumb is that one cubic foot per second to one acre-inch per hour. The general form of this equation as stated by Israelsen* is that $da=qt$, where d=depth of water applied in inches, a=area of field in acres, q=cubic feet per second, and t=time required in hours.

However, this equation is sometimes difficult to explain when dealing in common values of inches, acres, hours, or cubic feet per second. The problem is further complicated when the rate of flow is in gallons per minute.

Realizing the need for an easier method than was formerly available, the author developed the accompanying nomograph. Two thousand copies of this nomograph were printed and are being distributed to farmers of the W. C. Austin Irrigation District by the Oklahoma Agricultural Extension Service.

In the example shown, an irrigator finds that it takes 50 hr to irrigate a 31-acre field when he uses an irrigating stream of 4 sec-ft, or about 1800 gpm. He puts one end of his straightedge on 50 on the hours scale and marks through 4.0 sec-ft on the second-feet scale until he reaches the pivot line. From this point on the pivot line he marks through 31 acres on the acres scale and where this line crosses the inches scale is his answer in the number of inches of water applied to the field. In the example shown he is putting on an average depth of 6½ in.

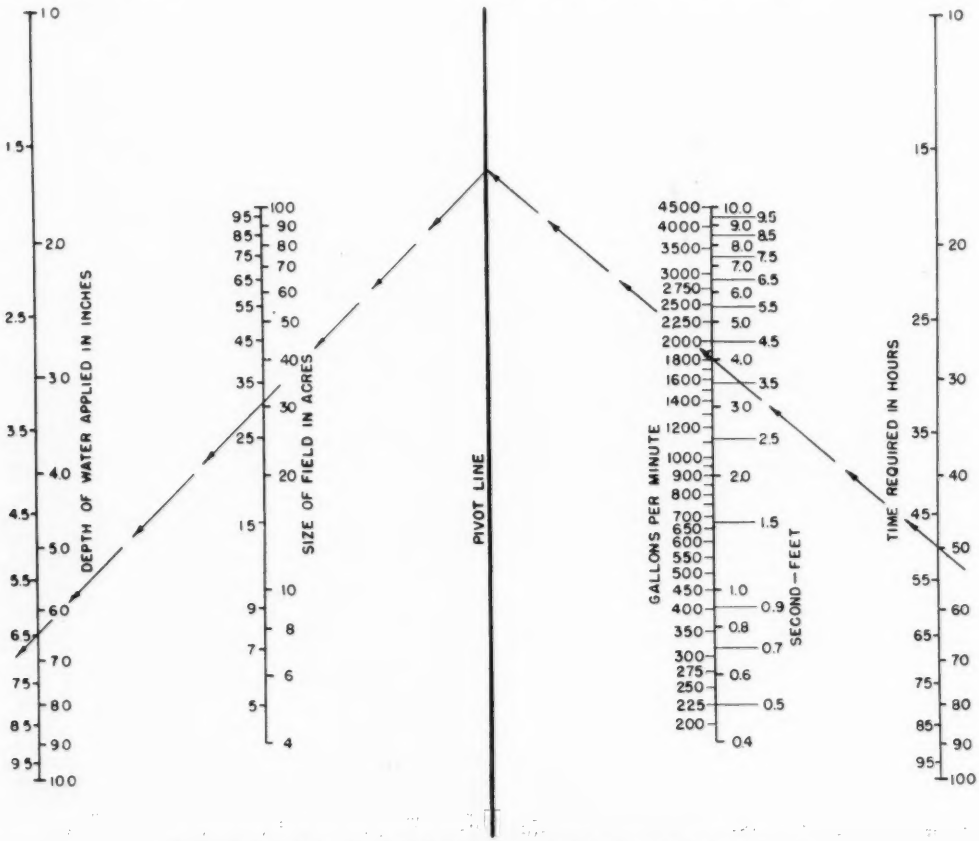
This nomograph can be adapted to plot work by moving the decimal point on each side of the pivot line the same total number of places in the same direction.

If three of the four quantities are known, the one unknown quantity can be found for sprinklers.

This article is a contribution of the Oklahoma Agricultural Experiment Station and is an adaptation of Bulletin B-368.

The author: JAMES E. GARTON, assistant professor of agricultural engineering, Oklahoma A. & M. College, Stillwater.

*Israelsen, O. W.: Irrigation Principles and Practices, 2nd edition, John Wiley and Sons. 1950.



A nomograph for finding the depth of irrigation water applied (prepared by James E. Garton)

The Dairy Stable Ventilation Problem

By C. N. Turner
MEMBER A.S.A.E.

WHILE some research workers on ventilation claim that the problem of ventilating a dairy stable has changed, the basic problem has not changed since King studied it over 40 years ago. While considerable study was made of carbon dioxide in the air, moisture and low temperature were major problems and still are the most important issues in the minds of dairymen today. Tighter stables, heavier feeding, higher producing cows, and fewer animals in a given area are recent differences to be considered.

In order to provide the optimum environment for the dairy cow and the maximum life of the dairy structure, a continuous change of air must take place in the stable. This premise would seem to be fundamental; otherwise, how can the animal receive a continuous supply of fresh air and how can the moisture she exhales be removed to prevent condensation on the structure surfaces and avoid rapid deterioration? Until more scientific information is available on "cow comfort" and effects on production, ventilation systems can best be sold on the basis of preserving the barn and of "human comfort" for working in the stable. Too little is known about the effects on production and cow comfort within the 45 to 60-deg temperature range. Results from pen stabling research show that the dairy cow does not have to be coddled in a uniform temperature environment. The most tangible impressions for convincing the dairyman of his need for better stable ventilation are beads of moisture on the walls and ceiling of the stable, frost on masonry walls and under the roof in the hay loft, white mold and black rot on wood surfaces, rust on the underside of metal roofs, the rusting of nails on roofs which may allow the roof to blow off, loss of paint on the outside walls, and loss of feed in the hay loft.

This paper was presented at the winter meeting of the American Society of Agricultural Engineers at Chicago, Ill., December, 1950, as a contribution of the Rural Electric Division.

The author: C. N. TURNER, professor of agricultural engineering, Cornell University, Ithaca, N. Y.

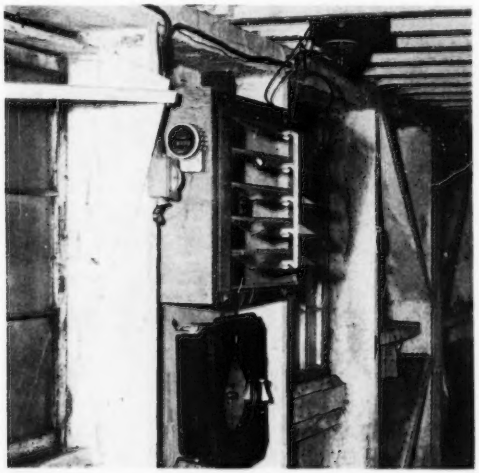


Fig. 1 The damper-motor-controlled louver provides full volume exhaust at the ceiling level during mild weather and restricted volume exhaust at the floor level in cold weather. The exhaust air temperature at the floor averaged 5 deg colder than that 3½ ft higher through the controlled louver. (Photo by courtesy of the New York State Electric and Gas Corp.)

In addition, we must never neglect the importance of the dairyman's comfort while working in the stable because he spends more time there than anywhere else during the ventilating season.

Even though all concerned will agree that fresh air is important, the visible signs of rapid deterioration of his building from condensed moisture released by his herd still represents the major problem to the dairyman. While air temperature and foul stable odors may also influence him in making the final decision to lay down the cash for a ventilation system, he will still judge that system on the basis of condensation of moisture which he knows will eventually destroy his barn. Therefore, since condensation of moisture occurs only on the colder days during the ventilating season, this has been the agricultural engineers dairy stable ventilation problem in New York state since we started research work on the subject in 1924.

There are two major functions of any ventilating system: (1) the control of the outgoing air and (2) the control of the incoming air. Too many fan manufacturers seem to feel that only the former is of consequence.

While it is true that air purity is important, properly controlling moisture usually solves the fresh air problem. Therefore, the major problem is to provide a ventilating rate which will prevent condensation on most building material surfaces and still not make the stable too cold. The ideal situation is to provide a variable rate of air change such that moisture will be removed at all times and yet the temperature be maintained within the 45 to 60-deg range. This has not been too difficult in well-stocked stables (wall area, 120 to 140 sq ft per cow) and with insulation equal to the resistance value of 4 or more. The minimum fan delivery for this has been established at 30 to 40 cfm for each 1000-lb animal unit exhausted at floor level, and the maximum delivery will depend upon the location of the stable and the length of the mechanical ventilating season, but 80 to 100 cfm has been found satisfactory for New York state conditions. One needs only to look at the degree days at Burlington, Vt. (7930); Albany, N. Y. (6658), and Philadelphia, Pa. (4749), to realize the importance of the geographic location of the stable. Also, the type of stable construction and therefore the resistance against which the fan must operate must be determined before the maximum fan delivery can be specified. Most dairymen turn their herds out every day for a short time and many leave them out a considerable length of time when the outdoor temperature is above freezing. This has minimized the high temperature problem in stables during mild weather.

Since the removal of moisture is the major problem, placing the exhaust fan in the stable area where most of the moisture is produced seems logical. However, exhaustive studies and years of experience have proved that in stables up to 200 ft long housing only a milking herd, satisfactory results can be obtained regardless of the fan location. In a stable 110 ft long, Fairbanks and Goodman used four fan units in a special study to obtain data on this point. Their placement in various areas of the stable either singly or together made no significant difference in the conditions throughout the stable. Many dairymen with combination milking and dry-stock stables ask to have the exhaust fan located in the coldest area of their stable to move the warmer air from the concentrated milking herd toward the maternity and calf pen area. This has been attempted repeatedly and found to cause excessive condensation in these colder areas. This problem can be solved more satisfactorily by controlling the flow of the incoming cool dry air than by trying to control the situation with the exhaust air. One-half size inlets in maternity and calf pen areas have been found successful. Millier suggests that the incoming air be proportioned on the basis of the weight of the livestock in any given area of the stable, since the heat pro-

duction and the moisture output are closely related to animal weight. Another solution, if and when the fan is placed in the cold area, is to insulate the walls and ceiling in these areas to bring the surface temperature up to that of the walls surrounding the milking herd.

As to the placement of the fan in the vertical plane of a stable, years of research and many more years of field results have proved that exhausting from the floor level is most desirable for temperature control. Scores of ventilating problems have been solved by placing a short exhaust duct on a fan located in the sidewall near the ceiling and more uniform stable temperatures result. Millier's data taken in 1948 and 1949 show that the floor level exhaust was most effective when the outdoor temperatures were the lowest and when animal heat was at a premium. M. A. R. Kelly, in USDA Bulletin 128, reported a 50 per cent advantage in the maintenance of stable temperature with near-floor exhaust over ceiling exhaust. Many more air changes are possible when exhausting the cooler air at the floor than at the ceiling and continuous ventilation can then be accomplished during the coldest weather. This problem may not be as important in the warmer climatic zones, but certainly needs serious consideration in zone 1 and most of zone 2. Full-capacity ceiling exhaust and restricted floor exhaust has been very successfully used in several dairy stables in the Binghamton area of the New York State Electric & Gas Corp. during the past two years. This unique assembly of a motor-operated louver and restricted floor duct on a single-speed fan was developed by Millier and Blair and is shown in Fig. 1. It can be assembled by the dairyman from units available at almost any heating and ventilating equipment retailer, and one manufacturer now offers this equipment as a complete packaged assembly. This installation solves an old problem by eliminating the large exhaust duct which was often an obstruction in the well-stocked stable. The power-operated louver with the restricted duct is best adapted to the small and medium-size dairy herd where better temperature control with a single fan installation is desired. Larger dairymen have used the two-fan system for about 15 years and good temperature control can be obtained by the one exhausting continuously from the floor level and the other on thermostat control exhausting from the ceiling level.

Too many dairy stable ventilation systems have been sold on the basis of what the exhaust fan will accomplish. One of our major problems is to get the dairyman to appreciate that his ventilation problems will be solved by the action of the incoming fresh, dry, cool air rather than by anything that the outgoing air can do. While it is true and appreciated that the fan is essential and provides the moving force, it must be remembered that the outgoing air has done its job by the time it reaches the exhaust point in the stable and the incoming air must do the work which we are asking the system to accomplish. If a part of the stable is cold, we need to restrict the flow of incoming air. If an area is warm, we increase the supply of incoming air. If the stable walls are wet, we provide a carefully directed flow of dry, cool incoming air. If we wish to avoid drafts, we control the direction, velocity and amount of the cold incoming air. Two years ago Millier found that, to reduce the heat loss through the wall, the incoming air can do that also if properly directed parallel to that wall either through the box-type, the slot-type, or bored-hole-type inlet. Special inlet openings for controlling the incoming air have always been a problem for the dairyman and the agricultural engineer, usually because neither of them fully appreciated the function of the openings. The slot inlet, however, has been a boon to both because of its effectiveness, simplicity and ease of installation.

While the dairymen in each state may have their special problems, following are those, in the order of their importance, which have been brought to our attention during the past twenty-five years:

1 Fresh air with less moisture, free from odors, and cooler than the stable air must be supplied to all parts of the stable in proportion to animal weight and without drafts.

2 Remove the moisture given off by the dairy cow to prevent deterioration of the building structure and eliminate feed spoilage. This must be continuous or moisture will find its way up into the hay loft whenever the exhaust system stops.

3 The maintenance of a temperature between 45 and 60 deg during the major part of the ventilating season. A 50 to 55-deg temperature seems to be the goal but wider fluctuations if gradual do not appear to be detrimental.

4 To obtain a relatively simple system at a reasonable cost.

5 To decide what system to buy in light of the many directly conflicting claims presented to the farmer.

While agricultural engineers in each state must consider the special problems of the dairymen, there should be some basic information on the over-all problem of ventilation which can be used as a basis for his design, and this problem is to:

1 Discourage the publication of directly conflicting recommendations until such time as they can be unified or qualified.

2 Correlate and simplify the fundamental data and physical laws which apply to the different climatic zones.

3 Prepare recommendations which can be adopted by manufacturers of ventilation equipment in order that they may fit it to the various climatic areas.

4 Encourage manufacturers to publish fan ratings under both free air and pressure conditions.

5 Train dealers to tailor their equipment and installation layouts to each job realizing that there are no two dairy stables exactly alike and that no packaged ventilating unit can be sold over the counter without numerous unsatisfactory installations.

Draintile Loading

(Continued from page 374)

and as settling does not affect α, the curves can be used to determine the effect of a change in the angle.

An effort was made to determine a relationship between the load factors for beddings made by various types of machines. This attempt was unsuccessful: the variation in load factors for machines of one make was as great as the variation in load factors for different makes of machines.

SUMMARY

The nomographs are a simplified presentation of the Marston load formulas intended to reduce the calculations involved in the evaluation of these to a minimum. They apply to a greater range of conditions than the widely used nomograph prepared by Miller (4).

Although no statistical analysis was made, the data gathered in the field survey show that, whereas most of the tile installed with modern equipment at moderate depths is not subject to excessive loading, in the case of deep cuts the minimum supporting strength of standard draintile as specified by the ASTM is sometimes exceeded.

The study of field bedding conditions showed a variation in load factors from 0.9 to 2.5. The graph of the load factor as a function of the angle between the lines of action of the reactions shows the relative magnitude of the load factor for different values of this angle, but because of the nature of the assumptions upon which the curves are based, the actual value of the load factor is likely to be somewhat greater.

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Drying and Storing Flaxseed in Texas

By J. W. Sorenson, Jr. and M. G. Davenport
MEMBER A.S.A.E. ASSOC. MEMBER A.S.A.E.

ROUGHLY the area adjacent to the Gulf Coastal Bend, extending from San Antonio east to Houston and south to Brownsville, is the proved flax area of Texas. Over 2 million acres in this section are well suited for flax production. Flax is a comparatively new cash crop in this area and is grown principally for seed for the production of linseed oil and meal. The harvested acreage has increased from 1,000 in 1938 to 273,000 in 1949.

Flax harvest in southern Texas usually starts during the last week of April or first week of May. This is the period of the highest humidity and of rising temperatures. Excess moisture at the time of harvest as well as lack of satisfactory methods of storing the crop often lead to serious deterioration.

In an effort to solve these problems, a series of tests was started at the Beeville Station in 1950 to develop practical and economical methods of drying and storing flaxseed on the farm. These tests are being conducted cooperatively by the Texas Agricultural Experiment Station, the Production and Marketing Administration of the U. S. Department of Agriculture, the Archer-Daniels-Midland Co., and the Great Lakes Steel Corp. This paper gives the results of one year's tests.

ARTIFICIAL DRYING

The drier used for the tests was a batch-type farm drier designed and tested by agricultural engineers of the Texas Agricultural Experiment Station. The capacity of the drier is approximately 78 bu or 4,400 lb of 6 to 7 per cent moisture flaxseed. This drier is shown in Fig. 1.

The drying unit consists of two vertical columns of seed separated by an airtight chamber 4 ft wide, 6 ft high and 9 ft long. Each column is 6 ft high, 9 ft long and 10 in thick. Heated air is forced into the central airtight chamber and through the columns of seed. The drier has a loading bin above the drying columns and an unloading bin below the columns. Sliding gates are provided at the top and bottom of each column. The seed can be transferred quickly from the loading bin to the drying columns and from the columns to the unloading bins with these gates.

Since the drier is operated on the batch principle, the loading bin can be filled with high-moisture seed while a charge is being dried in the columns. When the seed in the columns is dried, the sliding gates at the bottom of the columns are opened and the seed flows rapidly into the unloading bin below. The sliding gates are then closed and the gates at the top are opened so that the seed from the loading bin flows into the columns. The dry seed in the unloading bin is then removed and the loading bin refilled while the fresh charge is being dried.

A centrifugal, single-inlet, single-width blower with forward curve blades was used to force heated air through the columns of seed. The fan was operated by a 7½-hp, single-phase motor. A ½-hp, single-phase motor was used to operate the screw conveyor and another the portable elevator used on the drier.

The air going into the drier was heated by an injector-type industrial burner with a rated capacity of 500,000 Btu per hr based on 0.1-in draft through the burner. Propane was used as fuel.

Twenty-two batches of flaxseed ranging in moisture from 9 to 18 per cent were artificially dried in these tests. The moisture ranges were classified as low (9 to 11 per cent) and high (15 to 18 per cent). Seven batches were dried with an air temperature of 125 F, seven with 150 F, and seven batches with 175 F. Another batch was dried with natural air and one truck load of 545 bu was stored direct from the field without drying.

After each batch was dried, it was unloaded from the drier into storage bins or sacks. Samples were taken from each batch, before and after drying, and tests made to determine the effect of artificial drying on the oil content, acid number, iodine number and germination of the seed.

Results. The temperature of the seed in the center of the drier columns for the different air temperatures and air velocities used in these tests and the effect of the temperature of the drying air and air volume on the moisture content of the seed during drying are shown in Fig. 2.

It will be noted that there was considerable reduction in the temperature of the drying air in the center of the seed columns in most cases during the first part of the drying period. This was probably due to the cooling effect of evaporation. This also accounts for the fact that the seed temperature during the entire drying operation was always much lower than the temperature of the drying air. These tests indicate that the reduction in temperature at the start of the drying period and the length of time to regain the original seed temperature have a definite bearing on the rate of drying. This is shown by the fact that there was very little difference in the rate of drying with air temperatures of 125, 150 and 175 F until after the original seed temperature had been regained. During this time, about the same amount of moisture was removed for all temperatures. After this period, the air temperature in the center of the seed columns started to rise and resulted in an increased drying rate.

There was an increase in the drying rate in all of the tests as the temperature of the seed started to rise. When an air temperature of 125 F was used, there was a gradual increase in the rate of moisture removal with an increase in the temperature of the seed; however, this was apparently not high enough for either moisture range to increase the drying rate sufficiently to make this temperature practical as far as the time of drying was concerned. In drying low-moisture-content

This paper was prepared expressly for AGRICULTURAL ENGINEERING.

The authors: J. W. SORENSON, JR., and M. G. DAVENPORT, respectively, associate professor of agricultural engineering, A. & M. College of Texas (College Station), and assistant agricultural engineer, Substation No. 1 (Beeville), Texas Agricultural Experiment Station.

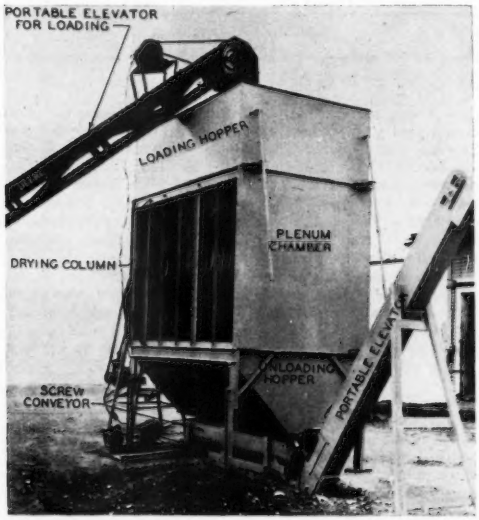

Fig. 1 Farm drier designed by agricultural engineers of the Texas Agricultural Experiment Station and used in the tests reported in this paper

seed (9 to 11 per cent) there was a slight reduction in the time of drying by using an air temperature of 150 F when the velocity of the air through the seed was 75 fpm. Nothing was gained by using an air temperature above 150 F. In drying high-moisture-content seed (15 to 18 per cent) there was a very significant reduction in the time of drying by using an air temperature of 175 F moving at a velocity of 85 fpm through the columns.

The capacity of any drier depends not only on the temperature of the air, but also on the volume of heated air brought in contact with the seed. For these tests, the fastest rate of drying and the lowest costs for power and fuel were obtained when the velocity of the air through the seed columns was 75 to 85 fpm. When delivering this amount of air, the fan operated against a static pressure of 3.30 to 3.50 in water column.

Cost of Operation. In drying seed with 9 to 11 per cent moisture with an air temperature of 125 F and an air velocity of 83 fpm, the cost for fuel and power was 38 cents per ton. For the same moisture range, the operating costs were 44 cents per ton with an air temperature of 150 F, when the velocity of the air through the seed was 75 fpm. As far as the time of drying is concerned, the 150 F air temperature seems to have some advantage; therefore, it will probably prove more economical in the long run to use an air temperature of 150 F.

There seems to be a definite advantage in using an air temperature of 175 F for drying 15 to 18 per cent moisture seed from the standpoint of both economy and time of drying. For example, with an air velocity of approximately 85 fpm, the cost for fuel and power was 60 c per ton with an air temperature of 175 F; 64 c with an air temperature of 150 F; and 74 c per ton with 125 F air temperature.

It is interesting to note the effect of air volume on the operating costs. Two lots of 9 to 11 per cent moisture content seed were dried with an air temperature of 175 F — one lot with an air velocity of 71 fpm and the other 55 fpm. The cost for fuel and power for the higher velocity was 50 c per ton while the cost of operation for the lower velocity was 74 c per ton. In drying 15 to 18 per cent moisture content seed with an air temperature of 125 F, the operating costs were practically the same for air velocities of 72 and 85 fpm. When seed of the same moisture range was dried with an air temperature of 150 F, however, the operating costs were reduced from 88 to 64 c per ton by increasing the air velocity from 70 to 83 fpm.

Germination. Based on the results of these tests, flaxseed with a moisture content up to 18 per cent, can be dried with air temperatures as high as 175 F and an air velocity of 80 fpm without detrimental effect on the germination. As brought out previously, the air temperature in the center of the seed columns was considerably lower than the drying air temperature during the entire drying period. For example, the maximum seed temperature in any test was 156 F and this was for only a short time. This indicates that the length of time the heated air is in contact with the seed has a definite bearing on the germination results. Therefore, much higher air temperatures can be used when drying seed in thin columns, as was used in these tests, than when drying seed at greater depths.

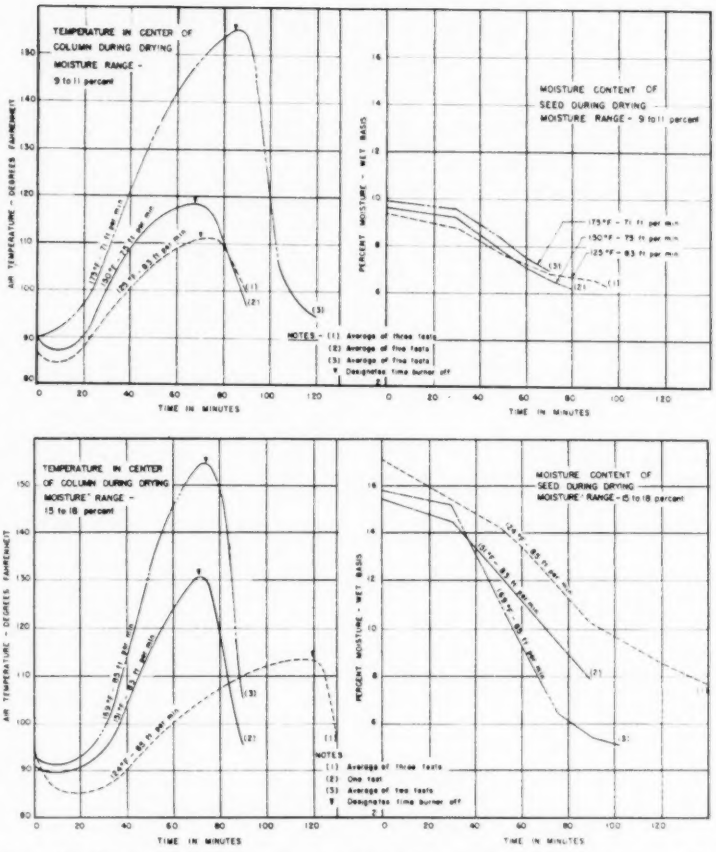
TEMPERATURE IN CENTER OF COLUMN DURING DRYING
MOISTURE RANGE - 9 to 11 percent
MOISTURE CONTENT OF SEED DURING DRYING
MOISTURE RANGE - 9 to 11 percent
AIR TEMPERATURE - DEGREES FAHRENHEIT
PERCENT MOISTURE - WET BASIS
TIME IN MINUTES
NOTES - (1) Average of three tests
(2) Average of two tests
(3) Average of two tests
Designates time burner off
TEMPERATURE IN CENTER OF COLUMN DURING DRYING
MOISTURE RANGE - 15 to 18 percent
MOISTURE CONTENT OF SEED DURING DRYING
MOISTURE RANGE - 15 to 18 percent
NOTES
(1) Average of three tests
(2) One test
(3) Average of two tests
Designates time burner off

Fig. 2 The effect of drying air temperature and volume on the moisture content and temperature of the seed during drying

Chemical Analyses. Samples were taken before and after drying to determine the effect of artificial drying on the chemical properties of the seed. These samples were sent to the Archer-Daniels-Midland Co. laboratories in Minneapolis where tests were made to determine the oil content, iodine number and acid number. Based on the results of these tests none of the samples investigated appeared to be injured by artificial drying with air temperatures of 125, 150 or 175 F.

STORING

Flaxseed was stored in bulk and in sacks for these tests. Three metal bins and one wooden bin, ranging in size from 500 to 1,000-bu capacity, were used for the bulk-storage tests. Three lots of 30 sacks each were stored in sacks. Thermocouples were installed in the bins and in the sacks and temperature observations made at regular intervals during the storage period.

All the bins and sacks were filled in June, 1950, with flax-

seed furnished by the Archer-Daniels-Midland Co., Kenedy, Tex. The seed remained in storage for four months and then was returned for processing.

The seed stored in two metal bins (bins F-1 and F-3) and a wooden bin (bin S-3-A) was artificially dried while that in another metal bin (bin F-4) was field dried. A false floor was installed in bin F-4 to permit aeration of the seed during storage. One 30-sack lot (sack I) was dried with unheated air while the other two lots (sack II and sack III) were dried artificially with air temperatures of 125 and 150 F, respectively. All sack lots were stored along one wall of a sheet metal barn with through circulation of the air.

Samples for moisture content, grade, oil content, iodine number, acid number and germination were taken as the seed was stored. Samples were also taken from each bin and sack lot at intervals during the storage period and comparative analyses made.

Results. In all cases the temperature of the seed at the start of the storage period was below 90 F. As can be seen from the graphs in Fig. 3, the temperatures of the seed stored in sacks remained below this level during the entire storage period. It will be noted, however, that there was a consistent increase in the temperature of the seed in all the sack lots until the last of July. After this time, the temperatures decreased gradually with a sharp drop in temperature the first part of September, corresponding to the drop in atmospheric temperature during this same period. The temperatures in all three lots followed very closely the same pattern with the exception of sack I at the start of the storage period. For some reason, during the first three weeks, the temperature of the seed in this lot (sack I) was higher than those in the other two lots. Later the temperatures in all three sack lots were about the same. At the end of the storage period, the average moisture content of the seed was 7.53 per cent in sack I; 6.69 in sack II; and 6.91 per cent in sack III. This was almost a one per cent increase in moisture content since the start of the storage period for sack I. On the other hand, the moisture content of the seed in sack III decreased over two per cent. There was only a slight increase in moisture content for sack II.

Bin F-1 was filled with six batches of artificially dried seed with the following moisture contents: 6.93, 6.70, 7.03, 6.70, 7.89, and 6.90. With the exception of the month of June, the seed temperatures in bin F-1 were consistently higher than those in the other bins. Bin F-1 was a steel bin 9 ft 10 in in diameter and 10 ft high. The temperatures in this bin were below 90 F until the middle of July. After this time, there was a steady rise in temperature with the temperature remaining above 90 F for the remainder of the storage period. The temperatures in this bin reached a maximum average of 96 F the latter part of August, when the seed in one area of the bin reached a maximum of 108 F. The seed was turned into another bin of the same size on August 26. This reduced the temperatures for a short time, but by September 13 the temperatures had reached almost 96 F again. The seed was aerated again by returning to bin F-1 on September 22.

Bin F-3 was a steel bin 14 ft in diameter and 8 ft high. During the month of June and the first half of July the seed temperatures in this bin remained below 90 F. There was a gradual rise in temperatures during this period and then they leveled off and remained close to 90 F for the remainder of the storage period. This bin was filled with eight batches of seed with moisture contents of 4.77, 6.87, 5.79, 7.31, 6.52, 6.25, 8.66 and 5.04. The average moisture content at the start and at the end of storage was 6.40 and 6.35 per cent, respectively.

Bin F-4 was also a metal bin the same size as bin F-3. A false floor was installed in this bin, however, to permit forced air circulation through the seed. The erection of this bin was

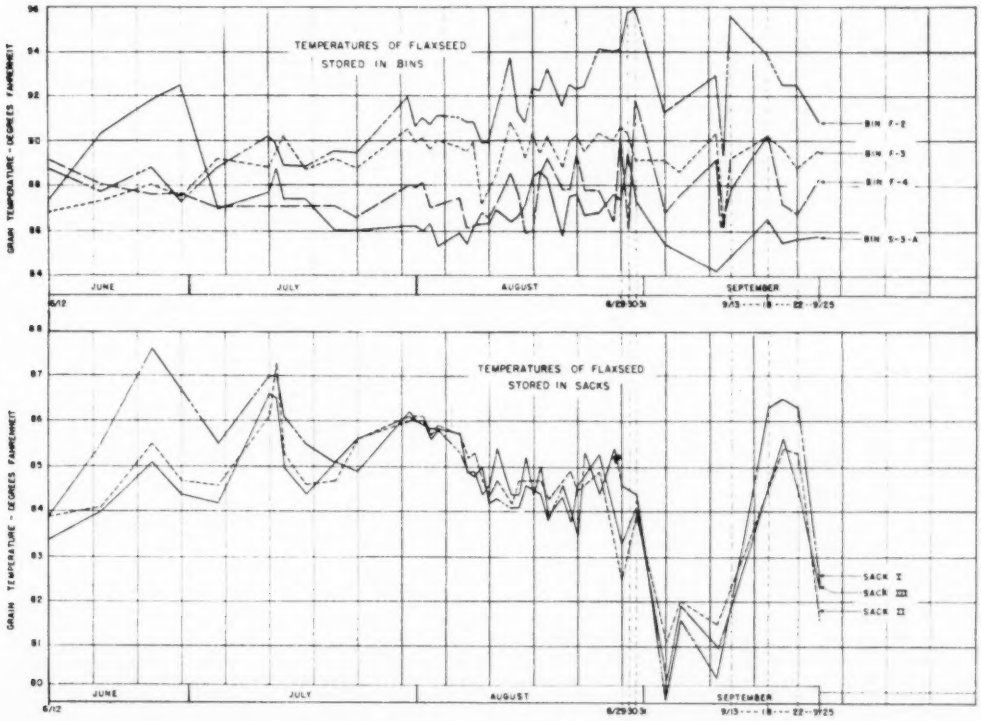

Fig. 3 Temperatures of flaxseed during storage

not completed until the last week in June. For this reason, it was necessary to store the flaxseed intended for this bin in another bin until bin F-4 was completed. The seed was stored in a wooden bin, which was also equipped with a false floor, for about three weeks and then transferred to bin F-4. This lot of seed was considered low enough in moisture when it was delivered to the station to permit storage without artificial drying. It is interesting to note that the seed temperatures in this bin were consistently lower than those in the other metal bins throughout the storage period. The moisture content of the seed dropped from 7.18 per cent at the start of the storage period to 6.74 per cent at the end.

Bin S-3-A was a partitioned area 4 ft 6 in by 14 ft, in the south end of a larger wooden bin. This bin was filled with six batches of artificially dried seed with the moisture contents of each batch as follows: 7.07, 7.05, 8.91, 7.68, 8.29, and 7.42 per cent. The temperatures in this bin started rising soon after storage, reaching a maximum average temperature of 92.5 F. In one area the temperature reached a maximum of 111 F. On investigation it was found that the highest temperatures were occurring in the areas containing the higher moisture content seed. The seed was aerated by turning into another bin and then back into the same bin. This reduced the temperature to an average of about 87 F. After this the temperatures were generally lower than those in the other bins, approaching closely the temperatures of the seed stored in sacks.

TYPE OF STORAGE IMPORTANT CONSIDERATION

In analyzing this data it appears that the type of storage is an important consideration in storing flaxseed. The excessive temperatures occurring in bin S-3-A are a good indication that moisture contents over 8 per cent are too high for safe bulk storage. However, for seed with a moisture content of 6 to 7 per cent it seems that the type of storage is the important factor in maintaining low temperatures. This is based on the fact that the temperatures were much higher in the metal bins than in the wooden bin and sacks. Also, it was found that the temperatures were consistently higher in bin F-1, which was the smallest in diameter of the three metal bins. It was also found that the temperatures were high in all sections of bin F-1; while those in the larger metal bins were high in certain areas—not over 2 ft from the outside wall and usually in areas on the west side of the bin. The temperatures were lower in bin F-4 than in bin F-3. Bin F-4 was equipped with a false floor, however, and may account for the lower temperatures. The seed in bin F-4 was also aerated when it was transferred to this bin which no doubt helped in maintaining the low temperatures.

There is no way to explain the reason for the high temperatures and the increase in moisture content in sack I, except for the fact that this lot was the center stack of the three lots and, therefore, it may not have received adequate air circulation.

Germination. There was a significant reduction in the germination of the seed in all of the bins except bin F-4. The exceptionally high temperatures occurring in bin F-1 throughout the storage period and for a short time in bin S-3-A probably accounted for the low germination in these two bins. The temperatures in one area of bin F-3 ranged from 92 to 96 F during most of the storage period. The average temperature for the entire bin, however, was 89 F. The temperatures in bin F-4 remained below 90 F during almost all of the storage period with an average of 88 F.

The germination was not affected in sack lots II and III. However, there was a significant reduction in germination in sack lot I. Apparently this reduction was caused by the rise in the temperature of the seed during June and part of July. It is interesting to note that the temperatures in the other two sack lots were below 86 F during all of the storage period.

Based on this information, it appears that temperatures above 86 to 88 F over a prolonged period will cause a significant reduction in the germination of the seed.

Chemical Analyses. Based on the results of the tests made by the Archer-Daniels-Midland laboratories at Minneapolis, all of the seed was stored without serious increase in acid number.

SUMMARY OF RESULTS

This report covers only one year's research. For this reason, the results are only an indication of what to expect and should not be considered conclusive.

Artificial Drying. The following summary is based on the results obtained with a column-type drier with seed columns 10 in thick.

1 There was a considerable reduction in the temperature of the drying air in the center of the seed columns in most cases during the first part of the drying period. This apparently had a definite bearing on the rate of drying since about the same amount of moisture was removed for all air temperatures during the first 30 min. After this period, the air temperatures in the center of the seed columns started to rise and resulted in an increased drying rate.

2 The air temperatures found to be the most efficient for drying flaxseed to 7 per cent moisture were 150 F for seed with 9 to 11 per cent moisture content, and 175 F for seed with a moisture range of 15 to 18 per cent.

3 The fastest rate of drying and the lowest costs for power and fuel were obtained when the velocity of the air through the seed was 75 to 85 fpm. When delivering this amount of air, the fan operated against a static pressure of 3.30 to 3.50 in water column.

4 The costs per ton for electric power and propane gas fuel were 41 c for seed with 9 to 11 per cent moisture and 60 c for 15 to 18 per cent moisture seed.

5 Flaxseed with a moisture content up to 18 per cent was dried with an air temperature of 175 F without detrimental effect on the germination.

6 The chemical properties of the flaxseed were not impaired by artificial drying with air temperatures of 125, 150 or 175 F.

Storing. The following is a summary of results of tests in storage of flaxseed in bulk and in sacks:

1 Excessive temperatures occurring in areas of bins containing over 8 per cent moisture seed were a good indication that this moisture content was too high for safe bulk storage. However, for seed with 6 to 7 per cent moisture it appeared that the type of storage was the important factor in maintaining low temperatures. This was shown by the fact that the temperatures were much higher in the metal bins than in the wooden bin and sacks. Also, it was found that the temperatures were consistently higher in the bin with the smallest diameter. The temperatures were high in all sections of the smaller diameter bins while temperatures in the larger bins were high only in certain areas — not over 2 ft from the outside wall and usually on the west side of the bin.

2 Flaxseed with a moisture content of 7 to 9 per cent was stored in sacks without a significant reduction in germination.

3 The low temperatures of the seed stored in sacks were attributed to the fact that the sacks were stored in locations with through ventilation and stacked in such a manner that air could circulate freely through the stack.

4 These tests indicate that provision should be made for aeration of the seed during storage, especially in metal bins.

5 Seed temperatures above 86 to 88 F over a prolonged period caused a significant reduction in the germination of the seed.

6 Flaxseed was stored both in bulk and in sacks without serious increase in the acid number.

Design for Progress

THE techniques employed should not be those common to advanced areas, but, instead, those which make use of the resources abundant in the area in question and minimize the use of its scarce resources. American engineers aiding such developments will be less often accused of uneconomic "overdesign" of installations, if they stop slavishly imitating the techniques they have seen used in their own country.— From "Economic Advancement of Underdeveloped Areas" by Yale Brozen in *Journal of Engineering Education*, June, 1951.

Detachable Pivot Hitch for Tricycle Tractor

By John W. Randolph and E. M. Dull
MEMBER A.S.A.E.

AN Everglades farmer growing extensive acreages of several high-value crops usually is obliged to carry out a very complex program of carefully timed spraying or dusting operations. Sometimes these are single in nature; frequently, they are of a multipurpose character. There is much evidence that a general-purpose chemical distributor may not fulfill all of the critical specifications for the control of insects, plant diseases, weeds and grasses, and the application of nutrients to the foliage.

The (University of Florida) Everglades Experiment Station, at Belle Glade, Fla., is conducting investigations to determine ways and means of improving the economy and efficiency of materials and methods for the control of crop pests. This paper, however, is limited to the transportation of equipment associated with specialized studies in which a tricycle tractor design is proving of special interest because it permits low-cost mounting and correct arrangement of units used for application of foliar dusts or sprays.

As a part of this work, a tricycle unit, which has a number of practical features not found in most machines of this general type, was designed and built in local shops, and is known as the Everglades "mule". The general design of this unit is given in some detail in the *Florida Grower* for January, 1950. It is the purpose of this paper to describe and illustrate in greater detail the connecting unit which is proving satisfactory from a number of standpoints.

The detachable pivot hitch shown in Fig. 1, makes the power-driven wheel a distinct unit. The U-bolt type of connection permits attaching any form of cart that may be desired for use with the power unit. This pivot connection is subject to critical stresses which are magnified by certain distances inherent in the basic design of a tricycle tractor. Fig. 2 shows that the main frame of the power unit is a bent section of a 10-in channel. The pivot shaft, a standard, light-weight truck axle, passes through and is bolted to the channel (Fig. 1). The pivot hub contains two large tapered-roller, anti-friction bearings, protected with dust seals and locked in position, as commonly used under similar conditions. Particular attention should be called to the proximity of the pivot's lower bearing to the channel and to the large traction tire.

Construction of the power wheel assembly, as shown in Fig. 2, requires some precise shop work in order to utilize standard automotive gears and bearings. The high costs associated with this phase of the fabrication are offset to some extent by the low cost of the cart which completes the tricycle tractor. Great freedom in the design and development of such carts, especially for a wide variety of adaptations requiring little traction, is afforded by the simplicity of the basic attachment shown in Fig. 1.

The problem of hitching the power wheel to carts of different loads has been made relatively simple if a concrete floor or other fairly level bearing surface is accessible. The power wheel is supported temporarily through the use of an A frame bolted to it while the tongue of the loaded cart is moved into position on an ordinary garage jack mounted on a dolly.

Fig. 3 shows a medium-clearance cart equipped for low-gallonage herbicide applications, and having quick-coupling hose connections for ease of disconnecting the tanks and boon assembly from the pump which is mounted on the power unit. In Fig. 4 is shown a high-clearance cart which has been equipped for high-gallonage, high-pressure spraying for the control of corn earworms. On this cart, the spray boom has been so attached to the four-bar-lift linkage as to permit the rapid exchange with other booms on which the nozzle arrange-

This paper was prepared expressly for AGRICULTURAL ENGINEERING.

The authors: JOHN W. RANDOLPH and E. M. DULL are, respectively, agricultural engineer and draftsman, Everglades Experiment Station, Belle Glade, Fla.

Acknowledgment: The authors acknowledge the interest and assistance of H. I. Cohn, a prominent farmer in southern Illinois, in the development of this equipment through two models. He used the first model in an intensive way, thereby developing a number of helpful suggestions for the second model.

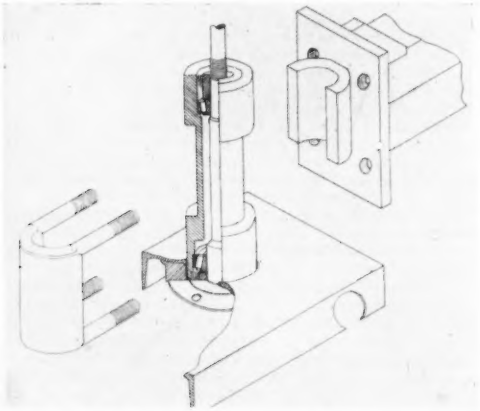

Fig. 1 Detachable pivot hitch for use with tricycle-type tractor

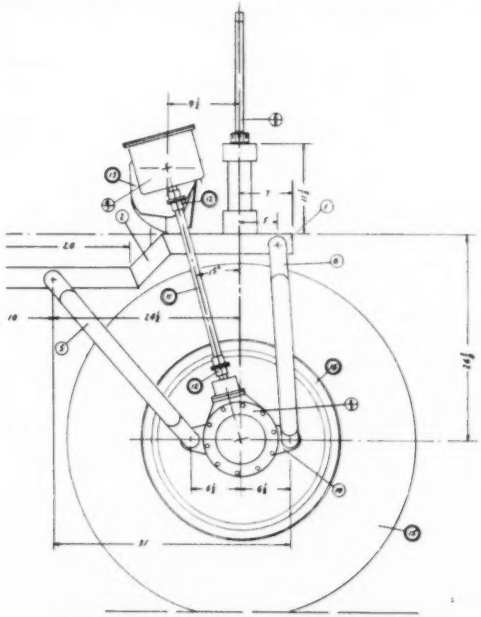

Fig. 2 Power wheel assembly of Everglades power unit

Fig. 3 *(Left)* Everglades "mule" power unit and medium clearance cart with weed sprayer • Fig. 4 *(Right)* This shows a high-pressure, high-gallonage weed sprayer adapted for use with the Everglades power unit

Fig. 5 Everglades "mule" with spray cart attached that is particularly adapted to experimental disease-control studies

ment has been predetermined, taking into consideration several factors such as crop, crop size, and insect pests to be controlled, among others. A similar cart was equipped with a special seven-row dusting applicator in the 1949-50 season.

The original "mule" had a mechanical clutch, operated by hand, which proved a great inconvenience in the field, since the position of the clutch lever changed with every change in direction of travel of the machine. A mercury-type clutch, operated centrifugally, replaced this mechanical clutch, increasing the independency of the power wheel while giving it a greater smoothness of operation and better control by the operator. A throttle control is mounted at the finger tips on the handle bar.

As a further improvement for the 1950-51 season, the three-spray tank arrangement, as shown in Fig. 5, was developed for small experimental plot work in certain pathology investigations. A two-cylinder engine, complete with fuel tank, storage battery and control panel, was mounted on the power-wheel frame in such a way that all the advantages of the detachable pivot hitch were retained.

The tire tracks in Fig. 5 indicate quite well the tractor's unusually good maneuverability and rapid-turning qualities, which are due primarily to the fact that the steering is direct, but with ample leverage. Quick turning is a necessity in experimental spraying, and this arrangement has proved quite serviceable for field work on loam soils and on muck lands; however, T. N. Jones, of the Mississippi Agricultural Experiment Station, reported marked steering difficulties when the drivewheel passed over deep surface irregularities on the clay soils in that region. These difficulties were largely eliminated through the use of a worm-gear steering assembly directly attached to the pivot shaft and hub shown in Fig. 1.

The power-wheel assembly with the pivot hitch referred to above could be adapted to a number of farm uses. Thus, with a low type of cart, it could be used for miscellaneous hauling or it could be adapted to pulling certain farm implements such as dump rakes, etc., if appropriate mechanical support is provided.

Deferment Policy for College Students

AMERICAN democracy has never claimed that all men should be regimented in the same pattern, do the same thing at the same time, assume the same precise responsibilities in an emergency, or be enslaved by equalitarian socialism. American democracy has, on the other hand, insisted that each man should do his part, that part for which he is best fitted, and in the time and manner which best serves the needs of our nation and our society.

We are in what is either an all-out war or a protracted mobilization calculated to prevent world war. For the winning of either and the establishment of world peace, we know we must have unprecedented industrial production. This conflict may be won by the nations achieving the greatest scientific progress based upon the soundest and most extensive research. The fire-power so produced, and the transportation to be developed will require the finest and most mature skills for their strategic use. Moreover, it is clear that the idealogical aspects of this conflict may be the dominant force and the determining factor. As none before, this will be a contest of production, science, research, skill, and leadership in action and ideas.

This means that any immediate expedient which cuts off the development of such skills and leadership is suicidal. First and primary consideration in planning for victory and for the successful preservation of our freedoms should have been the unhampered and uninterrupted training of scientists, production men, medical men, engineers, and qualified leaders for the armed forces and for the civilian programs. First measures on the part of politicians, militarists, citizens and educators should have preserved that thin red line of training of the best students available. First compulsion should have been that these men be required, not permitted, to continue their preparation for maximum service in this war.

This mobilization economy should be planned intelligently for the attainment of victory for the forces of freedom. Students qualified and able to study should be prepared for their greatest ultimate usefulness to the armed forces. . . .

It is time that everyone lay aside political considerations and concern for popular acclaim and think straight through to the defeat of our enemies and the enemies of free nations. It is time that we insist on the immediate, uninterrupted and increased training of doctors, surgeons, engineers, scientists, researchers, and leaders for all phases of military and civilian activity.—Extracts from a statement by R.C. Hutchinson, president, Lafayette College, in *Journal of Engineering Education* for June, 1951.

The 1951 A.S.A.E. Gold Medalists

C. E. SEITZ

The American Society of Agricultural Engineers awarded the Cyrus Hall McCormick Medal to Charles E. Seitz and the John Deere Medal to Charles N. Stone at Houston, Texas on June 20

C. N. STONE

TO SUM up in a single sentence the achievements of the man whom the Jury of Awards of the American Society of Agricultural Engineers chose to receive the Cyrus Hall McCormick Gold Medal for 1951, it could almost be said that in his life work has been the budding and flowering of agricultural engineering in the whole Southeast. Those who have shared in that development are first to honor the vision, the versatility, and the vitality which are the keys to his career.

Charles Edward Seitz was born November 6, 1890, at Reno, Nevada, son of Edward L. and Fannie Harvey Leonard Seitz. After attending the Reno schools and the preparatory school of the University of Nevada, he took work at the University in 1911 and 1912. Continuing his studies at Ontario Agricultural College, he earned the Associate degree in 1914. He was known as an outstanding quarterback at Nevada, and as a swimming star at Ontario.

As early as 1909 he had done irrigation work at the Nevada Agricultural Experiment Station, and in the two years following had worked in the engineering department of the Southern Pacific Railway. Then, in the year of his graduation, he became a Virginian, starting as state drainage engineer. Within two years he expanded his work to fill all the implications of extension agricultural engineer.

But there were interruptions. In 1916 he went with the 1st Virginia Cavalry to the Mexican border. Next year he returned to Iowa State College for special studies in agricultural engineering, but presently left to serve in the U.S. Air Force of World War I. Back in Virginia in 1919, he was connected with the Virginia Polytechnic Institute, Agricultural Extension Service and Agricultural Experiment Station.

Since 1922 he has served the Virginia Polytechnic Institute as professor and head of the agricultural engineering department, in charge of extension, research, and resident instruction.

Nearly everything he did, he started. It was Professor Seitz who organized the department of agricultural engineering in 1919, established a four-year curriculum, and made Virginia Polytechnic Institute the first college east of the Mississippi River to offer a B.S. degree in the subject. He organized the research program in the Virginia Agricultural Experiment Station and has ever since been head of its agricultural engineering department.

In 1924 he initiated and organized the rural electrification movement in Virginia, and served continuously as chairman of the state Committee on Relation of Electricity to Agriculture. In 1933 he prepared plans and proposals for a soil erosion control public works project *(Continued on page 386)*

AS HAS happened many times in the history of the gold medal awards of the American Society of Agricultural Engineers, the John Deere Medal for 1951 goes not to a man famous for some one or a few notable achievements, but to one whose lifelong concentration on "the application of art and science to the soil" adds up to such weight as to win, in the measured judgment of the Jury of Awards, this high honor. As has happened only once before, the major part of his career has been with various units of the John Deere organization.

Charles Newhall Stone was born June 10, 1884, the son of Elbridge K. and Cora (Edison) Stone. Before the year was out the family moved from St. Paul, Minnesota, to Quincy, Ill., where the elder Stone became superintendent of the local street railway. And there, at the tender age of ten, Charles started what was to be the soul of his life work — helping and handling men in productive labor. That is, he got a vacation job as water boy for a street railway construction crew. Pay, five cents an hour.

Two summers later he was timekeeper, and when he was thirteen he also made up the payroll for about a hundred men, standing by with all the answers when the cashier paid off. Along with this he checked deliveries of rails, brick, and other materials. The next five summers he worked as blacksmith's helper, driller, and finisher in the factory of the E. M. Miller Company at Quincy.

Shortly before graduation from the Quincy High School he won the Adams County scholarship at the University of Illinois, where he was graduated with the bachelor's degree in mechanical engineering in June of 1904. He was a member of Sigma Chi and of the honorary engineering fraternity Tau Beta Pi.

It was planned that he should go into his father's business, but shortly before graduation he was persuaded to have an interview with a John Deere executive. And so, with his father's blessing "at least for a year or two," began the engineering of men and materials in the making of tools to till the soil and machines to harvest its bounty for the benefit of mankind. It was on his twentieth birthday that Charlie Stone started at the John Deere Plow Works, pioneering in time studies for piecework rates.

At that time this was largely untrodden and rather dangerous ground. In the blacksmith shop, where most resistance was expected, the lad who had been a blacksmith's helper set up a system that commanded the respect of the men in the shop. Toward the end of the following year his department

head resigned, and for about two years Mr. Stone carried the added load.

He succeeded in securing and breaking in some able assistants. However, early in 1907 he had a long and severe illness, and by autumn his physician insisted that he seek a different climate.

Although Mr. Stone returned to the Midwest for a time during the succeeding year, it was not until late in 1911 that he renewed his association with the Deere organization. In the meantime he had spent eight months in Wyoming and Colorado; worked for a while with the Parsons Band Cutter and Self-Feeder Company, Newton, Iowa; and engaged in the logging business in Vancouver, B.C.

Resuming his connection with Deere and Company, he installed a piecework system at the Company's harvester works. The next year, 1912, he went to the Dain Manufacturing Company, Ltd., of Welland, Ontario, with increasing responsibility, and was made manager in 1914. In 1917 he took the added duty of managing the eastern Canadian sales organization. Late in 1919 he returned to East Moline as assistant manager and general superintendent of the John Deere Harvester Works, and in 1923 became its manager.

Mr. Stone was made a director of Deere and Company in 1926, and in 1934 was elected vice-president in charge of tractor, harvester and Canadian production. Since 1944 he has been vice-president in charge of product development for the entire company. Thus, in the culmination of a rich and varied career, he applies to an immense array of farming equipment the vision and judgment he has gathered along the way.

Illuminating his contribution to this sphere of agricultural engineering are decades of devotion to its research aspects. Indeed, he is known not as a writer but as a reader. He is one of the most fully informed men in the industry. Among his friends and associates he is known not only for the breadth of his learning and experience but for the breadth of his outlook. It is characteristic of him to give consideration to any and every possibility.

No doubt this accounts, at least in part, for the fact that other engineers like to work with him. It is in line with his life-long habit of thinking and working in human terms. He is keen for the strength and adaptation not merely of materials, but of men, summed up in his oft-said principle, "Get the right man in the right place."

Mr. Stone's wife is the former Helen A. Loosley, of Moline, whom he married in June, 1915. He has been a member of the American Society of Agricultural Engineers since 1937.

C. E. Seitz — 1951 McCormick Medalist

(Continued from page 385)

to which the Soil Conservation Service assigned a half-million dollars. He was an adviser to that Service, and chairman of the state Engineering Committee on Erosion Control.

In research, Professor Seitz personally conducted studies in land drainage, surface and overhead irrigation, dairy refrigeration, electricity on Virginia farms, rural electrification development, rural service organization of power companies, and agricultural engineering department organization in twenty colleges. He has directed all research in the whole scope of agricultural engineering, including farm structures, power and machinery, rural electrification, and soil and water conservation.

Most certain to be mentioned by his associates as a most notable achievement was construction of the new agricultural engineering building at VPI. It was during the depression when there was practically no money for anything. Somehow Professor Seitz secured a WPA grant, but for a grossly inadequate amount to fit his plans. But he also got hold of a hobo camp. Except for P. B. Potter and other members of his staff and two trained mechanics, he did the entire job with this transient labor.

In so doing, according to one friend, "He became sort of the 'chief transient' and took on all of their personal troubles to the extent that they came to look on him as something of a guardian angel for the whole group." Another says, "To me that building exemplifies Professor Seitz. In looking at it inside and out and then examining closely the laboratories, the shops, and so forth, nothing was left undone. It displays the methodical and determined mind of this man. While he is not a Virginian by birth, I never met a better one."

In the course of his career he has served on nearly a score of important state and national committees, conferences and congresses covering every aspect of his profession and some related fields. One of the more colorful was the United States-Chinese Agricultural Mission to China in 1946. Another involved a complicated athletic situation in which a football coach resigned in midseason and everybody was bitter. It all was dumped in Charlie Seitz' lap, and he has been president and chairman of the board for Virginia Tech Athletic Association since 1949.

With all his other responsibilities, Professor Seitz has been a versatile and prolific writer. In a bibliography, possibly not complete, he appears as author or coauthor of fourteen bulletins and circulars, and of 69 articles and papers. Among the latter are more than a dozen addresses to meetings of the American Society of Agricultural Engineers and contributions to AGRICULTURAL ENGINEERING.

Professor Seitz lacks only a decade of being a member of the Society since its founding, having joined in 1917. He was its president in 1932-33, has served as chairman of its College Division and of its Southeast Section, and on numerous of its committees. Other memberships include the American Society of University Professors, the Virginia Academy of Science, Sigma Alpha Epsilon, Epsilon Sigma Phi, Alpha Zetz, and University Club.

For all the range of his researches and his ability as administrator, he probably is most respected, and certainly most loved, as a great teacher — and this despite the fact that broader duties have in recent years kept him out of the classroom. He keeps a current file of all his agricultural engineering graduates, over three hundred of them, and from time to time surprises them with a letter of no special purpose but to inquire about them and to remain in remembrance. His interest in their guidance and placement has done much to account for their advancement and prestige.

Professor Seitz and his wife, Nancy H., have a son, Charles E., Jr., and a daughter, now Martha S. Wey. Like his father in the first World War, the son was a pilot in the second, but in the Marine Corps, and is again on active duty as a Marine flier. The daughter is wife of a former World War II Army pilot.

Aside from his grandchildren, Charles Seitz' interests include a hunting and fishing retreat transformed by his own hands from an old mountain cabin; making fine furniture and cabinet work; a return to his youthful interest in painting; and the collection of art items like vases, fabrics, china, and tapestries, such as he brought back from China.

Self-Feeding Structures

(Continued from page 375)

Panels and Self-Feeder Gates. Panels slide between the H columns and function as follows: To regulate the height of opening to control the feeding action of cattle, to close the feeding area to prevent freezing of silage, and to prevent spoilage at the bottom of the silo when it is filled and before feeding starts. Flexible hinged gates control the feeding action of the cattle, prevent injury to the cattle and prevent wastage of silage. Fig. 2 shows these panels and the feeder gates.

Spoilage at Top. There has been more top spoilage of silage than in a conventional silo because it is exposed for a longer time and fissures develop when the last portion of the silo is being emptied. Possibly a silage cap will retard this spoilage.

Research is being continued to determine the most satisfactory baffles, panels, gates, design of cone or duct, and sizes of self-feeders for different kinds of forage and different sizes of cattle.

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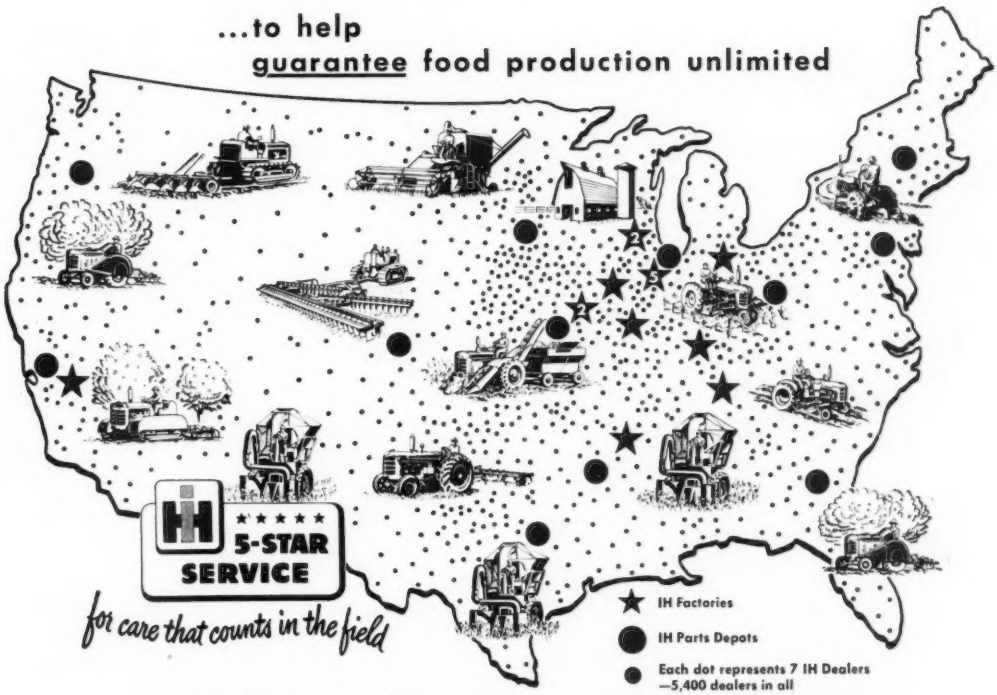

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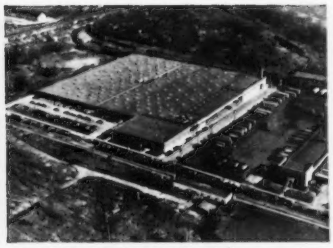

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NEWS SECTION

ASAE President Stanley Madill Takes Office

STANLEY M. MADILL is the new president of the American Society of Agricultural Engineers. He received the gavel and official responsibilities of the office from the retiring president, Fred C. Fenton, in a brief ceremony at the ASAE annual dinner, June 20, marking the close of the Society's 44th annual meeting, at Houston, Texas.

President Madill has been accumulating training and background for the position from the days of his boyhood on one of Iowa's tall corn

STANLEY MADILL

farms. He developed a keen interest in the mechanical equipment on his father's farm. Following his graduation from high school, he farmed for two years with his father before entering Iowa State College. There he was a "natural" for the agricultural engineering curriculum, and graduated as an honor student in 1927. As an undergraduate he had been elected to membership in Tau Beta Pi, Alpha Zeta, and Gamma Sigma Delta. He was also a member of the Student Branch of ASAE at his alma mater.

With scarcely a breathing spell following his graduation, he entered the engineering department of the John Deere Plow Works at Moline, Ill., for the intensive further training and development in engineering with which farm equipment manufacturers indoctrinate academic graduates. He also became an associate member of ASAE. Between 1927 and 1934 he moved up the line from draftsman to checker, designer, and development engineer in turn. During this period he went to Argentina with the first John Deere general-purpose farm tractors sent to that country, as an engineer on the design and development of planting and cultivating equipment to be used with these tractors for corn production under Argentina conditions.

Then he was made chief inspector at the Plow Works, and, in 1937, superintendent of its engineering department.

In 1939 he went back to Argentina as foreign representative and sales engineer for the export department of Deere and Company. This work required considerable traveling and gave an opportunity to get acquainted with the farming practices in many of the farming areas of South America.

World War II altered the export program, and Mr. Madill moved back to the United States in the fall of 1941, going directly to the Waterloo Tractor Works engineering department. There he served as an experimental engineer on tractors and implements and took an active part in the testing and development of the John Deere "Powr-Trol".

He was appointed to his present position as executive engineer in 1944. In this work he has been instrumental in expanding the engineering program, taking an active part in the training of new personnel. He has charge of the departments of current design, materials engineering, experimental engineering, engineering office personnel, engineering laboratory, machine shop, and pattern shop.

A.S.A.E. Meetings Calendar

August 27-29—NORTH ATLANTIC SECTION, Chalfonte-Haddon Hall, Atlantic City, N. J.

October 18 and 19—PENNSYLVANIA SECTION, William Penn Hotel, Pittsburgh, Pa.

October 18 and 19—PACIFIC NORTHWEST SECTION, Pullman, Wash., and Moscow, Ida.

December 17-19—WINTER MEETING, The Stevens, Chicago, Ill.

June 16-18—ANNUAL MEETING, Kansas City, Mo.

NOTE: Information on the above meetings, including copies of programs, etc., will be sent on request to A.S.A.E., St. Joseph, Michigan

Mr. Madill is also a member of the Society of Automotive Engineers, the Waterloo Technical Society, Methodist Church, Masons, and Elks. He has two daughters, Carol Ann and Jean Marie, who are both students in West Waterloo Senior High School.

ASAE North Atlantic Section Meeting, August 27-29

THE yearly meeting of the North Atlantic Section of the American Society of Agricultural Engineers will be held at Atlantic City, N. J., August 27 to 29, with headquarters at Chalfonte-Haddon Hall. The opening program of the general session on Monday, August 27, will include two speakers, the first, L. P. Shannon, eastern manager, extension division, E. I. du Pont de Nemours & Co., who will tell how some of the products of modern industrial chemistry were created, what made them possible, and how they fit into the national economy. As the second speaker it is hoped to have William McMillen, editor-in-chief, "Farm Journal", to discuss some of the more significant aspects of the subject "Looking Ahead in Agriculture".

The afternoon session of the first day will be devoted to four concurrent technical programs. The Farm Structures program will consist of a panel discussion on new developments in coatings for farm use. The Rural Electric program will include new developments in underfloor heat for chick brooding, a new control for infrared lamp brooders for chicks, low-voltage, remote-control wiring systems, and a review of the tamper-resistant fuse situation. The Soil and Water program will include a presentation on the reclamation of tidal marshlands in the Maritime Provinces of Canada; other subjects planned for this program are still in the tentative stage. While still incomplete, the Power and Machinery program will include a discussion of farm machinery requirements for grassland farming and a paper on valve rotation in tractor and automotive engines by a representative of the Ethyl Corporation.

The program for August 28 will open with a business meeting of the North Atlantic Section, followed by a general session for the remainder of the forenoon. Dr. Houston Peterson, chairman, department of philosophy, Rutgers University, will address the group on the subject "Anxiety, Anger, and Animation." There is a possibility that this session may be addressed also by Vincent Shafer, General Electric Co., on the subject of rainmaking. The program will close with a motion picture dealing with the subject of farm safety.

The afternoon program of the same day will be given over to three concurrent technical programs. A joint Soil and Water and Power and Machinery program will include a panel discussion on methods and costs of earthmoving for soil conservation structures. The Farm Structure program will open with a paper on potato storages for the Long Island, New Jersey, and eastern Pennsylvania areas, and this will be followed by a panel discussion for the remainder of the session on what is new in farm structures under the leadership of J. F. Schaffhausen, Johns-Manville Corp. The Rural Electric program will be devoted to a symposium on mechanical conveying and elevating of farm materials, including a report of a dairy stable gutter cleaner survey, discussion of an inclined portable forage elevator and of a vertical silage elevator, experiences with commercial hay-curing equipment, development of a farm crop drier, and field studies on the use of supplemental heat in drying baled hay.

The program on the forenoon of August 29 will open with a special program on ASAE student branch activities with speakers representing three student branches of the Society who will discuss how the student branch helps make the student a better prospective member of ASAE. Following this feature, Herbert Voorhees, president, New Jersey Farm Bureau Federation, will speak on the farmer's position in the national mobilization program.

Non-members as well as members of ASAE are cordially invited to attend this meeting.

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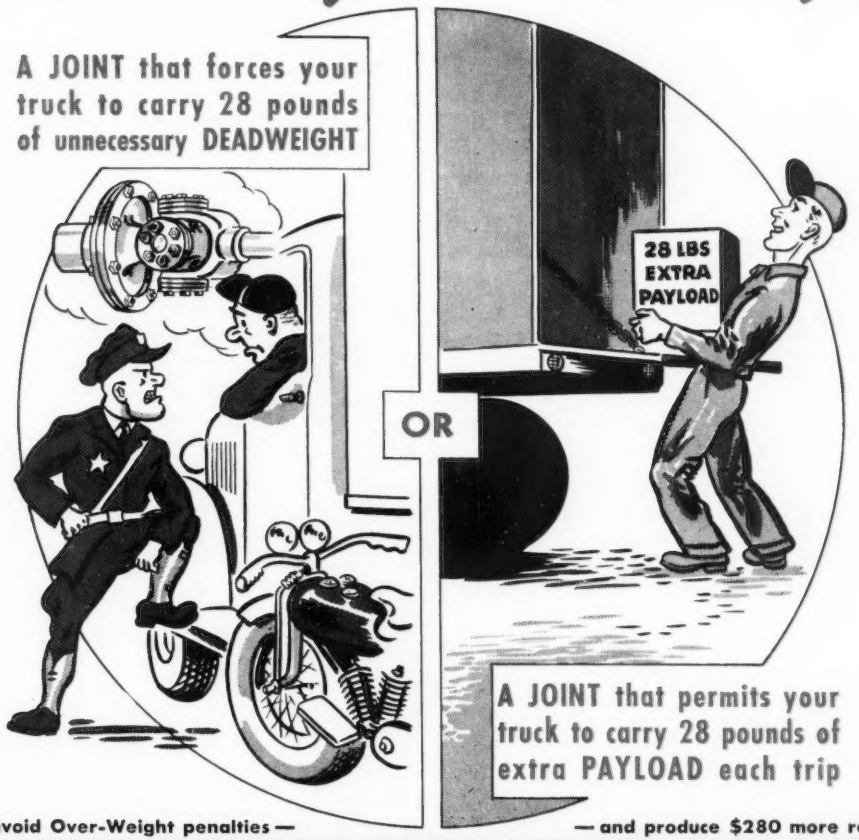

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Lamp Heads New Ohio Section

AT THE organization meeting of the Ohio Section of the American Society of Agricultural Engineers, held May 19 at Ohio State University, elected Benjamin J. Lamp, Jr., instructor of agricultural engineering, Ohio State University, as the first chairman of the new section. Thomas P. Christen, Jr., agricultural engineer, Standard Oil Co., was elected vice-chairman, and Cernyw K. Kline, extension agricultural engineer, Ohio State University, was chosen as secretary-treasurer. Members of the nominating committee elected for next year are W. A. Harper, chief engineer, National Farm Machinery Cooperative; R. J. McCall, manager, New Way Farm Sales, Inc., and R. D. Barden, professor of agricultural engineering, Ohio State University.

The forenoon activities commenced with a tour of the Ohio State University agricultural engineering facilities, followed by a business meeting in which by-laws were adopted, section policies established, and officers elected. The luncheon, held at the OSU faculty club, was attended by 52 members and guests. Following the meal, Prof. G. W. McCuen made a few remarks and introduced Dean Turnbull, who welcomed the group and wished them success in their new section venture.

The afternoon program, arranged by D. C. McCoy, Frigidaire Div., General Motors Corp., featured three men who are prominent in Ohio agriculture and industry. Louis Bromfield, author and farmer, gave a very interesting talk on the place of engineering in the new agriculture, pointing out the numerous applications of engineering which are contributing greatly to the success of Malabar farm.

As a farm boy who made a success in industry and then returned to the farm determined to be an outstanding farmer, George T. Christopher, former president, Packard Motor Car Co., shared his rich experience in a talk, entitled "A Man from Industry on the Farm." This was followed by a thought-provoking talk on research, entitled "Path Finding in the Nation Today" by T. A. Boyd, consultant, General Motors Research Laboratories. Mr. Boyd described the vital role basic and applied research has in promoting progress and in guaranteeing our future security. He emphasized that all great war-time developments have stemmed from peacetime research.

The ladies enjoyed a separate program, either going shopping or visiting the Ohio State Archæological Museum in the morning. In the afternoon they attended a tea and social.

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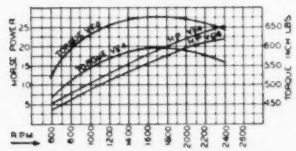

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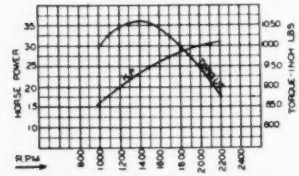

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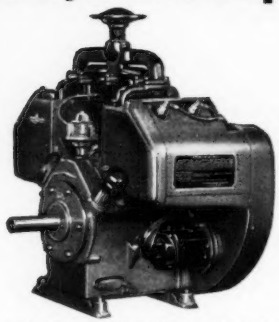

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		21.5 at 2400	25 at 2400	31 at 2200
Net weight in lbs., Standard Engine		295	295	410
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Washington Section Program

AT ITS regular monthly meeting, May 11, the Washington (D.C.) Section of the American Society of Agricultural Engineers was addressed by Leo E. Holman, recently named assistant head, Division of Farm Buildings and Rural Housing, U.S. Department of Agriculture.

Mr. Holman stressed the need for more adequate grain and specifically corn-drying facilities of the size that could be used on individual farms. Drying, he stated, is no longer an emergency measure but has matured to the point that it is used by those realizing its capabilities as a usual practice, thus allowing earlier harvesting during more favorable weather conditions.

In the Midwest more attention to crop conditioning is bringing about increased usage of the picker sheller where corn is a primary crop.

Holman further discussed a USDA publication, now in preparation, which describes the construction of a farm-size column grain drier that offers the advantages of continuous drying to farmers.

George J. Burkhardt of the University of Maryland agricultural engineering department followed Holman on the program and discussed the local grain drying situation. He considered wheat conditioning the primary problem in Maryland, and pointed out that even with low moisture content deterioration took place. He threw out the suggestion for consideration that weed leaf juices introduced into the grain by the combine may affect its storage-keeping qualities. Aging before storage was described as a possible solution.

NEW BULLETINS

Tests on the Design of Wood Box Columns, by B. Y. Kinzey, Jr. Wood Research Laboratory, Virginia Polytechnic Institute (Blacksburg). Reprint from Civil Engineering and Public Works Review (London, January, February, and March, 1951). Analysis and test results show that properly designed box columns give substantially greater load-carrying capacity per board foot of lumber than can be obtained in solid columns.

Electric Farm Welders, by William H. Knight and J. W. Martin. University of Idaho (Moscow) Farm Electrification Leaflet No. 14 (June 1, 1951). Elementary information on arc welders for farmers considering investment in this equipment.

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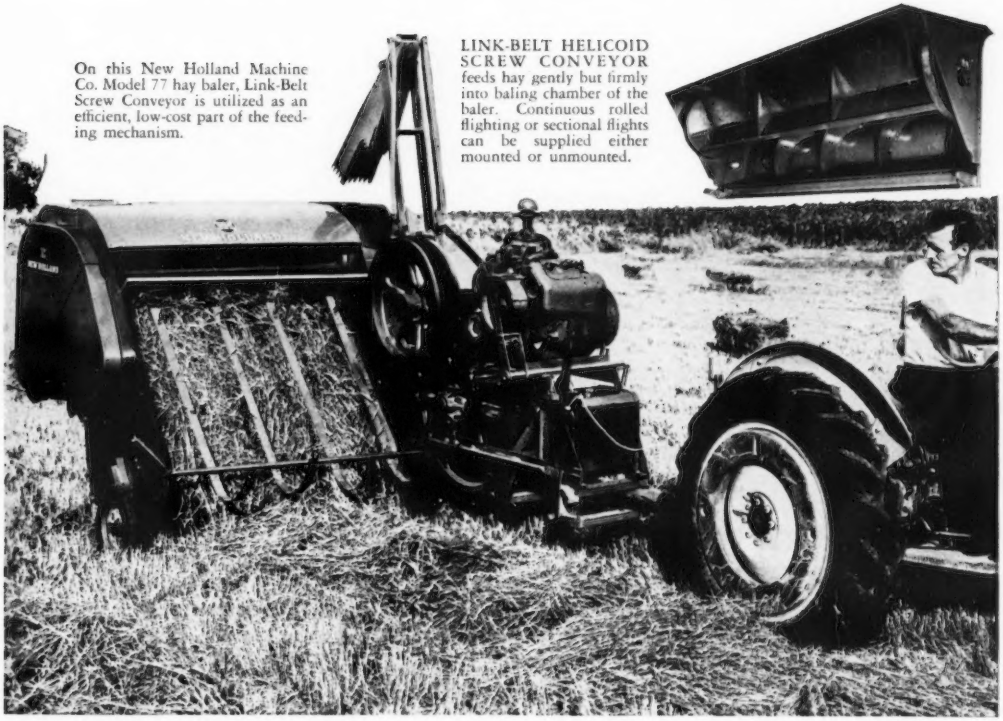

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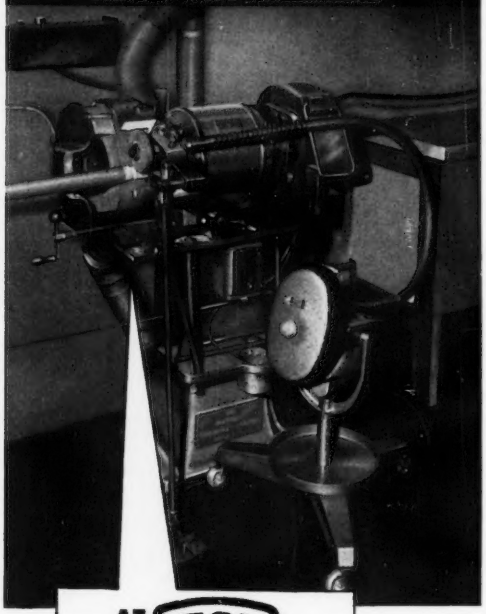

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L. W. Chase Passes

LEON WILSON CHASE, charter and life member and past-president of the American Society of Agricultural Engineers, and one of the pioneer college agricultural-engineering department heads, passed away May 31 at his home in Lincoln, Nebraska, at the age of 73. From boyhood experience as the son of a pioneer farmer he had progressed through a lifetime of professional service in the pioneering of ideas.

Some time after he was born on a hill farm in Vermont in 1877, his family moved west. He grew up on farms in Nebraska and Kansas, living in the stone dugouts and sod houses of that time and area.

After graduation from high school at Pawnee City, Nebraska, in 1899, he worked his way through the University of Nebraska, receiving

LEON WILSON CHASE — 1877-1951

his bachelor's degree in mechanical engineering in 1904. As an undergraduate he was elected to Sigma Tau and Sigma Psi.

His first employment as an engineering graduate was with Fairbanks, Morse and Company, and later with the International Harvester Co.

A classmate, J. B. Davidson, was employed following graduation to carry on and develop the work in agricultural engineering and farm mechanics at the University of Nebraska started by O. V. P. Stout and C. R. Richards. When Mr. Davidson left in 1905 to undertake similar work at Iowa State College, Mr. Chase responded to a call to return to the University of Nebraska to take up and further develop its agricultural engineering work.

By July, 1908, he was associate professor in charge of a separate department of farm mechanics. The University records him as the second head of the department. He had begun to attract promising young associates, including O. W. Sjogren and C. K. Shedd. Within the next two years the engineering phases of the department's work were emphasized, it was redesignated as the department of agricultural engineering, and it was offering a four-year curriculum in the college of engineering.

Mr. Chase was one of the seventeen who met at Madison, Wisconsin, in December, 1907, and there organized the American Society of Agricultural Engineers. He was elected its first secretary, and, in 1913, its sixth president. Throughout these early days he was an active leader in making the Society and agricultural engineering practically synonymous.

In 1914 he was honored with two professional degrees, Agricultural Engineer, conferred by Iowa State College, and Mechanical Engineer, conferred by the University of Nebraska.

During World War I he served as a Major of Ordnance, and for some time after his return to the University was active as a Colonel in the reserves.

When the Nebraska Tractor Test Law was enacted in 1919, the work of conducting the tests was delegated to the University, and assigned by it to his department. He and his associates did the pioneering work of developing the tests so that they would produce information of direct and immediate value to farmers, and of longer range value in helping designers and manufacturers to improve their tractors.

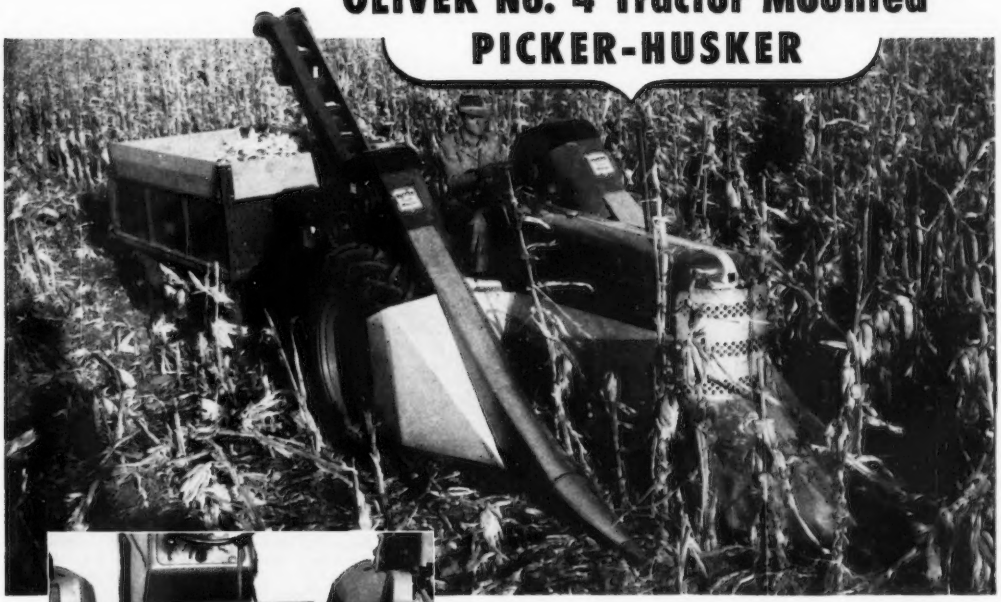
For a time he was also professor of mechanical engineering and chairman of the mechanical engineering department at the University.

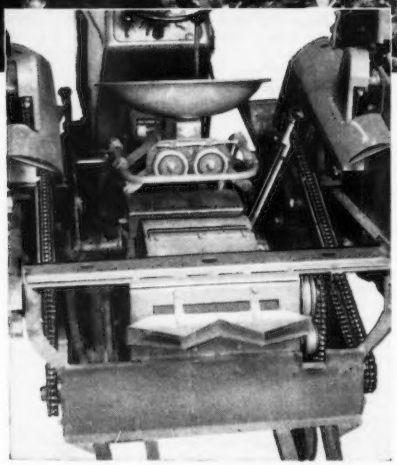
In 1921 he left the University to establish and head the Chase Plow Company. This application of engineering to agriculture became his primary interest, and he was still actively associated with it as a director at the time of his passing.

At various times in his long and busy career he was also active in the Society for the Promotion of Engineering Education, the American Society of Mechanical Engineers, Society of Automotive Engineers, Lincoln Engineers Club, Nebraska Manufac- *(Continued on page 394)*

THE "PICK" OF EFFICIENCY

OLIVER No. 4 Tractor Mounted PICKER-HUSKER





TOP: Action scene showing Oliver No. 4 Mounted Picker on "77" Tractor. BELOW: Close-up of Picker revealing Diamond Roller Chains, driving gathering and husking units from power take-off.

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● Under the present-day emergency program and farm manpower shortage, efficient agricultural equipment like the Oliver Picker-Husker serves to keep up farm production.

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2. Marlows are the only irrigation pumps delivered completely equipped. No extras to buy . . . no other costs. Just add fuel and oil and they're ready to go.

3. Marlow makes the world's most complete line of sprinkler irrigation pumps. Available in 14 centrifugal models — a size, capacity, mounting and power type for every sprinkler irrigation need.

4. Marlows are sold and serviced from coast to coast by leading irrigation equipment distributors. You are never far from complete, prompt Marlow attention.

5. Marlow sprinkler irrigation pumps are backed by the excellent Marlow reputation for quality — a reputation earned by a quarter century of manufacturing pumps that can't be beat. Ask any Marlow pump user.

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That's why, if the question is sprinkler irrigation, Marlow is the answer.

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Also manufacturers of the World's Most Complete Line of Self-Priming Centrifugal Pumps

NEWS SECTION *(Continued from page 392)*

turers Association, Lincoln Manufacturers Association, and Farm Equipment Institute.

The Council of the American Society of Agricultural Engineers elected Mr. Chase to life membership in 1943.

He was a member of the Second Presbyterian Church of Lincoln. Funeral services were held Monday, June 4. He is survived by his wife, Susan B. Chase, a son, two daughters, five brothers, one sister and five grandchildren.

Necrology

CARL G. WIDSETH, manager, steel building and farm equipment division, Miller-Piehl Equipment Co., passed away at his home in Davenport, Iowa, Sunday evening, June 17, at the age of 46. He had been in poor health for the past two months.

Born at Gonvick, Minn., Mr. Widseth attended the Northwest Minnesota School of Agriculture at Crookston and the University of Minnesota, where he received his bachelor's degree in agricultural engineering in 1923.

Prior to his graduation he worked for several summers on the European corn borer control project in Pennsylvania and New York. Following his graduation, he first was employed as junior engineer with the division of drainage, Minnesota department of conservation. Next he served 18 months as educational director in a CCC camp. From this position he was promoted and served another 18 months as district educational director. In 1937 he became an agricultural field representative of the Portland Cement Association. After several years in that capacity, he was named service manager in the northwestern region for Harry Ferguson, Inc. He had been associated with the Miller-Piehl organization since 1946. He has been a member of the American Society of Agricultural Engineers since 1938.

He is survived by his widow, Alice Bolky Widseth, four sons and a daughter, his mother, Mrs. Caroline Widseth, four brothers and two sisters. Funeral services and interment were at St. Paul, Minn.

PERSONALS OF ASAE MEMBERS

Morris E. Blooduorth, irrigation and drainage engineer, Lower Rio Grande Valley Experiment Station (Texas), is one of the cooperators in work recently covered in progress reports, entitled "A Tractor-Mounted Spray for Cotton Defoliation" (1284) and "The Yield and Quality of Cabbage Affected by Different Levels of Fertility and Irrigation" (1289).

Liston N. Drury recently became electrification adviser with the Talquin Electric Cooperative, Inc., at Quincy, Fla. He previously filled a similar position in the vicinity of Jacksonville.

Leonard J. Fletcher, director of training and community relations, Caterpillar Tractor Co., was honored by Iowa State College on June 16 when he received the Chicago Alumni Merit Award. This award, inaugurated in 1932, is bestowed upon outstanding alumni for meritorious service in their fields and their contributions to their fellow men. Mr. Fletcher is a past-president of ASAE (1931-32), and the Society awarded him the Cyrus Hall McCormick Medal in 1944.

James E. Garton, assistant agricultural engineer, Oklahoma Agricultural Experiment Station, Stillwater, has developed a graphic solution of airplane sprayer problems along the same lines as his previous solution for field sprayer problems. It is published in leaflet form as Miscellaneous Publication MP-20.

William E. Hart has joined the staff of the experiment station, Hawaiian Sugar Planters Assn. in Honolulu as an assistant agricultural engineer. He is working on cutting of cane preparatory to dry removal of leaves and dirt, and on fertilizer distribution. Hart received a B.S. degree at the University of California and did his graduate work at the University of Nebraska, where he served as an assistant in irrigation research. *(Continued on page 396)*

PROFESSIONAL DIRECTORY

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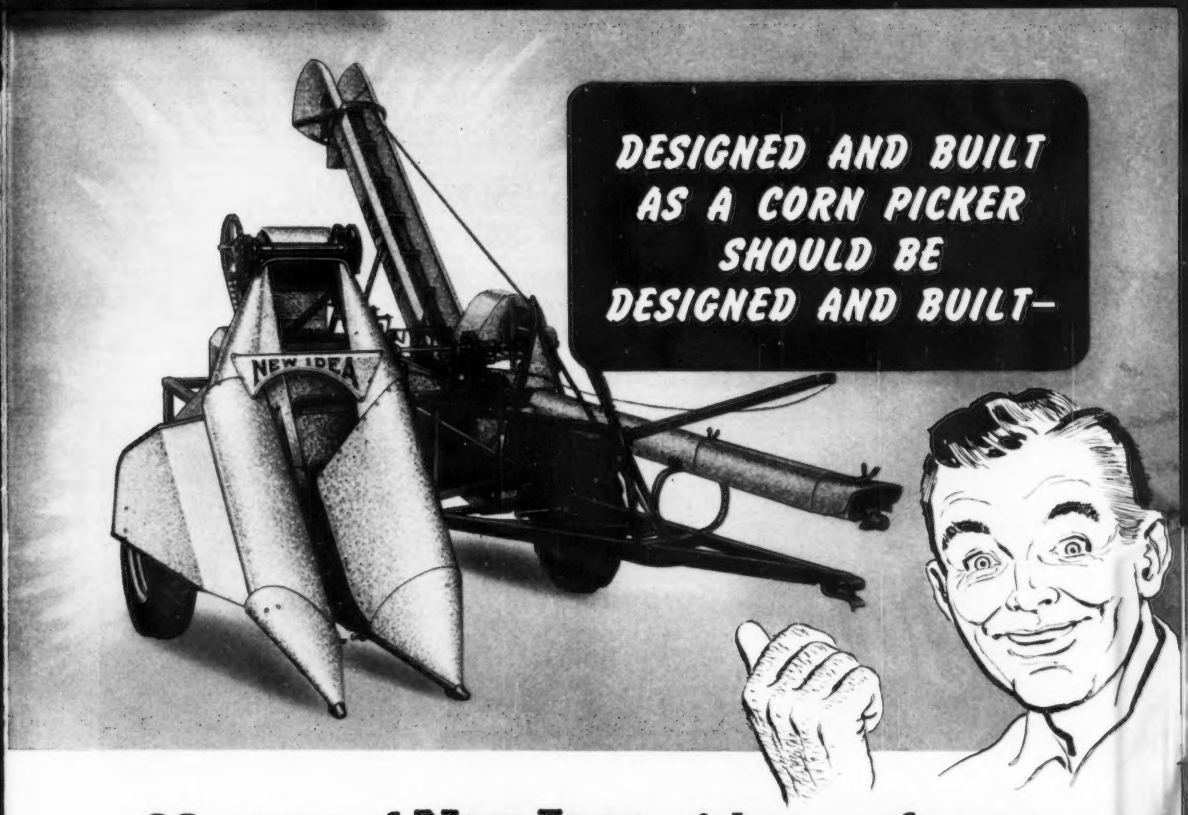
RATES: Announcements under the heading "Professional Directory" in AGRICULTURAL ENGINEERING will be inserted at the flat rate of $1.00 per line per issue; 50 cents per line to A.S.A.E. members. Minimum charge, four-line basis. Uniform style setup. Copy must be received by first of month of publication.



DESIGNED AND BUILT AS A CORN PICKER SHOULD BE DESIGNED AND BUILT—

23 years of NEW IDEA picker performance

PROVE IT! Regardless of field and crop conditions—soft ground, excessive humidity or dryness, down and tangled stalks, tall corn or short corn—New Idea Pickers pick clean and quick.

One man with the aid of tractor and wagon can pick, husk and load from 8 to 12 acres of corn per day with this one row machine. Tractor is quickly hitched or unhitched, and is never "tied up" when needed for other farm work. It's a good idea to own a New Idea Picker.

FLOATING POINTS
get the "down" stalks

Here is one of the most important reasons why New Idea leads the field.

Fig.1

Fig.2

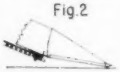


Fig.3

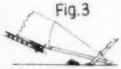
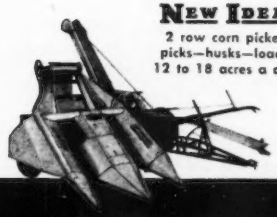


Fig.4

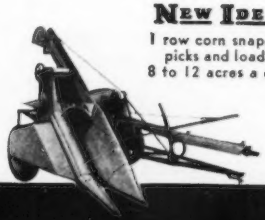
COMPARE

Fig. 1 & 2 show ordinary picker design. Points tend to lift and ride over down stalks.

Fig. 3 & 4 show New Idea floating points which return to regular position immediately. Fewer stalks are missed.



NEW IDEA
2 row corn picker picks—husks—loads 12 to 18 acres a day

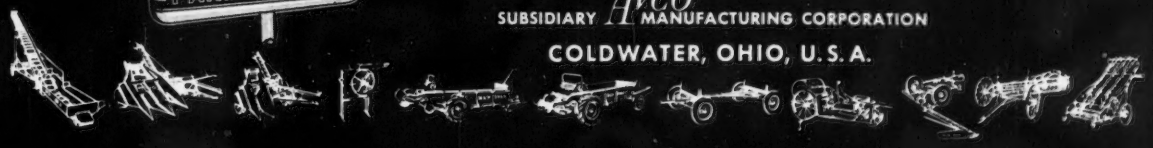


NEW IDEA
1 row corn snapper picks and loads 8 to 12 acres a day

NEW IDEA FARM EQUIPMENT

NEW IDEA
FARM EQUIPMENT COMPANY
SUBSIDIARY AVCO MANUFACTURING CORPORATION

COLDWATER, OHIO, U.S.A.



PERSONALS OF ASAE MEMBERS

(Continued from page 394)

Marc M. Hornish is now employed in agricultural engineering and farm management and appraisal service for the Edward S. Raque Organization, realtors, 13 East Chicago St., Elgin, Ill.

F. E. Rowland, manager of the agricultural department of the General Electric Co., Ltd., London, was recently elected president of the Institution of British Agricultural Engineers.

Malcolm E. Sargeant, assistant agricultural engineer, Central Vermont Public Service Corp., was recently elected chairman of the Vermont Electric Utilization Council, organized at Burlington, June 1st, by representatives of electric power companies, electrical dealers and contractors, and extension service representatives, to serve as a state-wide clearinghouse for general and technical information on electrical equipment. Another ASAE member, *Benjamin A. Jones, Jr.*, assistant extension agricultural engineer, University of Vermont, was elected secretary-treasurer of the Council.

NEWS FROM ADVERTISERS

New Products and Literature Announced by AGRICULTURAL ENGINEERING Advertisers

McCormick Self-Washing Cream Separator. International Harvester Co., Chicago, Ill., recently announced a new cream separator that flushes, power washes, sterilizes, and dries itself in three minutes. It eliminates the drudgery of hand washing, as not a single part is disassembled for washing. Before it is stopped, after finishing one separating, it has been readied for the next.

All that is needed is a pail of cold water and six quarts of hot water. Four quarts of the cold water are used to flush out the cream and wash the supply can. The rest of the cold water is used for power washing, with the separator running alternately at full speed, then at two-thirds to three-fourths speed. Sterilizing is accomplished in a similar manner using the hot water.

The separator has no gears and never needs oiling. Bowl and motor are directly connected and operate as one unit. The separator's two precision-fitting, anti-friction bearings are double-sealed and lifetime-lubricated. All metal parts contacting the milk are stainless steel.

The new McCormick self-washing cream separator

Minneapolis-Moline "Uni-Harvestor". A new self-propelled farm machine has started production in the plants of Minneapolis-Moline Co., Minneapolis, Minn. Initial production will include a combine attachment so that it

The Minneapolis-Moline self-propelled unit, or "Uni-Tractor"

can be used as a self-propelled combine and an attachment for use as a self-propelled two-row corn picker. Other attachments are in the testing or planning stage and include a combination corn-picker and sheller, a wire-tying baler, and a forage harvester. All attachments are designed for quick mounting on a power unit, called the "Uni-Tractor". This is done by the use of only one bolt, two slip pins, and two spring-release pins. A small hoist is available for mounting or removing the attachments.

JUST OUT

NEW DELAVAN Agricultural Spray Nozzle CATALOG

It's Easy to Use!

★ Easy to find the standard capacity of any Delavan nozzle.

★ Gives Capacities for BOTH Flat Spray Nozzles (for spraying weeds) and Interchangeable Cone Spray Nozzles (for spraying insecticide).

★ Shows ACCESSORIES for any spraying application.

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MULTI-PURPOSE

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YOU NAIL TO STRAN-STEEL FRAMING

STRAN-STEEL AND QUONSET REG. U. S. PAT. OFF.

FARMER'S FAVORITE . . . EVERYWHERE!

Quonsets are all steel. They are wind-resistant, non-combustible. They are quick to erect. They are reasonable in cost. (Total in-place cost will surprise you!) They are versatile. They are strong and long-lasting . . . made of arch-ribbed, nailable Stran-Steel framing.

Quonset 32

Quonset 24

Quonset 40

All over America you see them . . . Stran-Steel Quonsets . . . on farms of all types and sizes.

There are many reasons for such preference for this busiest of all farm buildings.

The Quonset is versatile . . . perfect for crop storage, housing livestock or machinery, and dozens of other uses. More than that, the Quonset is an efficient, shirt-sleeved working tool that increases production, cuts leg-work and back-breaking drudgery to a minimum.

Doubtless you know someone who has a Quonset building on his farm. We suggest you talk to him. Or call in your Quonset dealer and get a list of the farmers in your section who have solved the farm building problem—profitably—with one or more Quonsets. Use the coupon for valuable information on buildings best suited to your type of farming.

Use this coupon for information about Quonsets as a farm production tool. We will include data on sizes, colors, and the name of your nearest Quonset dealer, from whom you can get the detailed costs.

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Applicants for Membership

The following is a list of recent applicants for membership in the American Society of Agricultural Engineers. Members of the Society are urged to send information relative to applicants for consideration of the Council prior to election.

Aldred, William H.—Trainee, Southeast Ford Tractor Co. (Mail) Thomson, Ga.

Berry, James E.—Meherrin, Va.

Bhaguati, Lalit K. N.—Res. fellow in agr. eng., Iowa State College, Ames, Iowa.

Bosley, Kenneth T.—Graduate student in ind. eng., University of Maryland. (Mail) Sparks, Md.

Broughton, John E.—Sales engr. trainee, mechanical goods div., Goodyear Tire & Rubber Co. (Mail) 949 Dopler St., Akron 3, Ohio.

Buelow, Frederick H.—Graduate asst. in agr. eng., Purdue University, Lafayette, Ind.

Chandler, William C.—Lowry Hall, University of Missouri, Columbia, Mo.

Cheek, Charles D.—Agr. engr. (SCS), USDA. (Mail) General Delivery, Ulysses, Kans.

Cleland, Willard C.—Agr. engr., Corps of Engineers, U.S. Army. (Mail) R R 2, Eskridge, Kans.

deBuhr, Harold E.—Box 13, Thompson, Iowa.

Dickerson, Ralph L.—Asst. agr. engr., Mississippi Agr. Exp. Sta., State College, Miss. (Mail) Box 175.

Easley, O. W.—Agr. engr., Mississippi State College, State College, Miss.

Fahnestock, Clarence R.—Graduate student, Pennsylvania State College, State College, Pa. (Mail) Alpha Zeta House.

Fenn, Arthur R.—Agr. engr. (SCS), USDA. (Mail) Philip, S. D.

Gammon, Edgar E.—Graduate student, agr. engr. bldg., University of Maine, Orono, Me.

Griffin, Richard E.—Engr., Utah State Engineer office. (Mail) 1032 N. 4th East, Logan, Utah.

Harkness, Kenneth A.—Agr. eng. dept., Kansas State College. (Mail) Scott City, Kans.

Harrison, Curtis B.—39 Via Floreado, Orinda, Calif.

Heath, Wilson C.—R R 2, Whitesburg, Ga.

Henderson, James L.—Gen. mgr. and chief engr., Robinson Ventilating Co., Zelienople, Pa.

Holderman, William M.—Fort Stanton, N. M.

Hughes, Thomas J.—Reg. mgr., Harry Ferguson, Inc. (Mail) 1410 Waldheim Bldg., Kansas City, Mo.

Hunt, Donnell R.—Instructor in agr. eng., Iowa State College, Ames, Iowa. (Mail) Agr. Eng. Bldg.

Jensen, Laurence W.—Agr. engr. (SCS), USDA. (Mail) 2729 S. 14th St., Lincoln, Nebr.

Landreth, James—Agr. engr., Tea Research Institute of Ceylon, Talawakelle, Ceylon.

Lehman, Alan M.—Asst. farm mgr., Lehman Fruit Farm, R R 1, Girard, Pa.

Malm, Donald I.—Student engr., John Deere Waterloo Tractor Wks. (Mail) R R 2, Lindsborg, Kans.

Manning, Francis V.—John Watts Co. (Mail) R R 2, Clinton, Ia.

McCause, Edson R.—Farmer, 1502-1st, LaGrande, Ore.

McGlamery, Floyd I.—Agr. engr. (SCS), USDA. (Mail) Jetmore, Kans.

Mo-Gregersen, Fridtjof—Plant engr., Blobus Maskinfabrikk, Brumunddal, Norway. (Mail) Kvernenga.

Mortimer, Richard B.—7326 Church St., Pittsburgh 18, Pa.

Myers, Jack L.—Electrical advisor, KRB Public Power District, Ainsworth, Nebr.

Orsborn, William H.—R R 2, French Camp, Miss.

Schulbach, August, Jr.—R R 1, Box 663, Astoria, Ore.

Simons, Allison K.—Res. engr., Bostrom Mfg. Co., 133 W. Oregon, Milwaukee, Wis.

Sitz, Robert C.—Box 986, Burns, Ore.

Smith, Robert F.—Cambria, Va.

Suires, Howard H.—Layout draftman, eng. dept., International Harvester Co. (Mail) East Moline, Ill.

Taylor, James H.—R R 2, Belmont, Miss.

Tosello, Rino N.—Head, irrigation res., Instituto Agronomico, Campinas, S. Paulo, Brazil. (Mail) Rua Olavo Bilac 187.

Trice, Richard H.—R R, Shipman, Va.

Varshney, M. C.—Asst. engr., Govt. of India. (Mail) P O Mahewa (Etawah), UP, India.

Voorhees, William A.—Asst. to supt., Electric Wheel Co., Quincy, Illinois.

Walkington, William G.—Hazelton, Ida.

Watts, Galen F.—Havensville, Kans.

Westfall, Robert J.—District agent, Martin Steel Products Corp. (Mail) 1925 Avenue H, Fort Madison, Iowa.

White, Charles E.—Asst. mgr., Harry L. White Farming Operations. (Mail) R R 1, Box 464, Gold Hill, Ore.

Williams, Malcolm M.—Jr. farm rep., Gulf States Utilities Co. (Mail) Box 146, Silsbee, Tex.

Witzenburg, Marion J.—Trainee, Caterpillar Tractor Co. (Mail) 305 East 3rd St., Pella, Iowa.

Wolff, Victor F.—Eng. dept., Phillips Petroleum Co., Bartlesville, Okla. (Mail) 1305 Osage St.

TRANSFER OF MEMBERSHIP GRADE

Barnes, Kenneth K.—Asst. prof. of agr. eng., Purdue University, Lafayette, Ind. (Associate Member to Member).

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American Crop Drying offers you the only *complete* line of drying equipment on the market—heat drying, air drying, bins and moisture testing equipment. In addition, All-Crop Dryer capacities are GUARANTEED. You can recommend this equipment to the farmer knowing that it will fully handle his crop drying needs. Write today for details.

MODEL 18
All-Crop Dryer
Underwriter's Labs Approved
For the average sized farm. Automatic safety and temperature controls. 780,000 BTU output per hour, 11,200 cu. ft. air per minute. Equipped with vane-axial fan and single furnace. May be powered by 3, 5, or 7½ h.p. electric motor or gasoline engine. GUARANTEED capacity.

MODEL 25
All-Crop Dryer
For the larger farm. Drys all crops. Equipped with vane-axial fan and double furnace. BTU output, up to 1,560,000 per hour. Air output up to 20,050 CFM at 5 H.P. Automatic safety and temperature controls. Powered by electric motor, gasoline engine or tractor. Capacity GUARANTEED.

MODEL 606
Vane-Axial Fan
Only portable **complete** crop curing Fan-Unit on the market today. Vane-axial design assures more air delivery for those hard to cure crops. Air output, 20,050 CFM using 5 H.P. electric motor. Motor and belts shielded for protection and safety.

MODEL M-20
ALL-CROP
MOISTURE TESTER
Saves guess work. Electric . . . simple to use. . . gives accurate direct reading of moisture percentage. Farm tested, and proved.

American—the oldest exclusive manufacturer of portable farm crop drying equipment

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CRYSTAL LAKE, ILLINOIS

Windrow Magic

Ford TRACTOR

TO CUT, cure, rake, load and finally feed hay to an animal requires a lot of handling. The more you handle hay the more of it you lose.

The most critical step in the sequence is getting hay into windrows. The very nature of this job requires a considerable amount of handling.

Conventional side delivery rakes travel hay at a 22° angle in relation to the direction of tractor travel. Tests reveal that each wisp of hay in the windrow formed thereby, on the average, moves about 12 feet. Feed-rich leaves take a beating; all too many of them get knocked off.

This Dearborn Rake makes magic windrows, puts more money in the farmer's pocketbook! It travels the hay at a 44° angle in relation to the direction of tractor travel. Hay in these magic windrows has moved only about 7 feet—just a little over half the distance! The reel basket's *rotating-pushing* motion not only puts hay into the windrow faster but also tucks leaves inside, exposes hard-to-dry stems! Ford Tractor Hydraulic Touch Control helps get more of the crop too; it lifts and lowers the reel basket as field and crop conditions warrant.

This Dearborn Rake, coupled with Ford Tractor power and control, is one more example of the better ways of doing old jobs that are being made available to farmers today.

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Dearborn FARM EQUIPMENT

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Personnel Service Bulletin

The American Society of Agricultural Engineers conducts a Personnel Service at its headquarters office in St. Joseph, Michigan, as a clearing house (not a placement bureau) for putting agricultural engineers seeking employment or change of employment in touch with possible employers of their services, and vice versa. The service is rendered without charge, and information on how to use it will be furnished by the Society. The Society does not investigate or guarantee the representations made by parties listed. This bulletin contains the active listing of "Positions Open" and "Positions Wanted" on file at the Society's office, and information on each in the form of separate mimeographed sheets, may be had on request. "Agricultural Engineer" as used in these listings, is not intended to imply any specific level of proficiency, or registration, or license as a professional engineer.

NOTE: In this bulletin the following listings still current and previously reported are not repeated in detail; for further information see the issue of AGRICULTURAL ENGINEERING indicated.

POSITIONS OPEN: NOVEMBER—O-102-510. DECEMBER—O-113-514. 1951 — APRIL—O-226-525. JUNE — O-293-526.

POSITIONS WANTED — NOVEMBER—W-99-18. 1951—JANUARY W-140-25, 145-27. FEBRUARY—W-156-31, 162-33, 164-35. MARCH—W-116-36, 120-37, 172-39, 184-40, 185-42, 188-43. APRIL—W-196-44, 202-46, 227-47, 212-48, 229-50, 219-51. MAY — W-252-53, 253-54, 276-56, 277-57. JUNE — W-264-58, 260-59, 232-60, 251-61, 261-62, 280-63, 262-64, 263-65.

NEW POSITIONS OPEN

AGRICULTURAL ENGINEERS (3) for research on cotton ginning, castor bean mechanization, and other problems in the farm machinery field, in a state college in the Southwest. One of the three openings will require ¼-time teaching of seniors and graduate students. MS deg in agricultural engineering, or equivalent. Research experience desirable. Usual personal qualifications for public service research. Normal opportunity for advancement. Age, under 35. Salary, $3600-5500 range, depending on experience and position filled. O-299-527

AGRICULTURAL ENGINEER for extension work primarily in farm machinery, in a state college in the east central area. Work is with county agents farmers, and farm organizations, and involves about 100 days travel per year. BS or MS deg in agricultural engineering, or equivalent. Farm background and experience in the selection, operation and maintenance of farm machinery desirable. Usual personal traits for public service positions. Good opportunity for advancement. Age 25-35. Salary open. Expense account. O-300-528

AGRICULTURAL ENGINEER (instructor) for teaching farm power and machinery, rural electrification, irrigation, and drainage in a state college in the Southwest. This college is designated for Smith-Hughes teacher training and has excellent shop facilities, class rooms, and offices. MS or BS degree in agricultural engineering or equivalent. Practical and teaching experience desired. Must be willing to cooperate and show interest and initiative in helping build the department. Excellent opportunity for advancement. No age preference. Salary $3300-3400 for 9 mo. Possibility of half-time teaching during summer. O-301-529

AGRICULTURAL ENGINEER (instructor) for teaching and research in a state college in the north central region. First preference for man interested in farm structures; next choice man interested in power and machinery. MS deg in agricultural engineering or equivalent preferred. Man with BS deg will be considered if other qualifications favorable. Teaching experience desirable. Usual personal qualifications for college teaching and research. Normal opportunity for advancement. Age 22-35. Salary $3800-4000 range for man with MS deg and teaching experience, somewhat less for lower qualifications. O-304-530

ASSISTANT ENGINEER for planning, design, and estimating on an expanding line of prefabricated farm buildings, with manufacturer in a north central state. BS deg in agricultural engineering, or equivalent. Farm background and construction or architectural experience desirable. Good cooperator with aptitude for commercial development engineering. Good opportunity to grow with organization. Opening to be filled as soon as suitable man can be employed. Age 25-30. Salary open. O-305-531

NEW POSITIONS WANTED

DESIGN, development, or management in power and machinery or farm structures field, preferably in farming operation in South. BS deg in agriculture, major in agricultural engineering, 1947, University of Florida. Farm background. Veteran's on-farm-training instructor 26 mo. Junior engineer-appraiser with Federal Land Bank (present position) 10 mo. War enlisted and commissioned service in Navy, 3 yr. Single. Age 26. No disability. Available on 30-day notice. Salary open. W-205-66

TEACHING or research or both, in power and machinery or soil and water field with college or experiment station, preferably in the East. BS deg in agricultural engineering, 1949, Pennsylvania State College. Farm background. Farm division manager, Sears Roebuck store, over one year. Factory time study, 6 mo. Currently in service work with farm equipment dealer. War service in Navy 33 mo, including 18 mo with civil engineer corps and 15 mo with destroyer escort. Single. Age 26. No disability. Available on reasonable notice. Salary open. W-255-67

DESIGN, development, research, or writing in power and machinery or farm structures field in industry or public service, preferably in South. BS deg in agricultural engineering, 1950, University of Georgia. Experience in machine shop work, 17 mo; general construction 10 mo; tobacco curing research 3 mo; sales and service with full line farm equipment company 11 mo; mechanical draftsman 2 mo. War enlisted service in Navy over 2 yr. Aviation machinist mate 2/C. Married. Age 27. Minor vision defect corrected by glasses. Available now. Salary open. W-289-68

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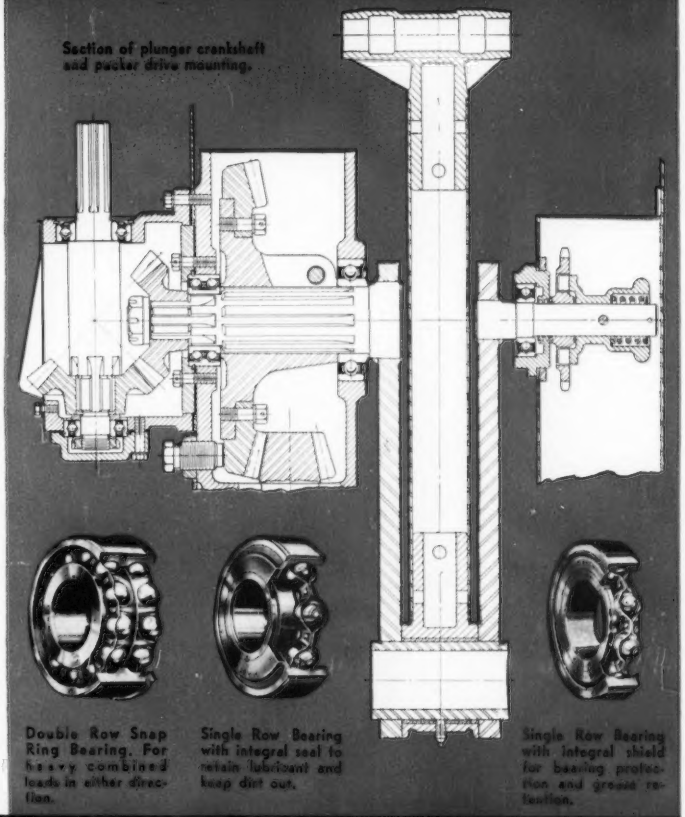
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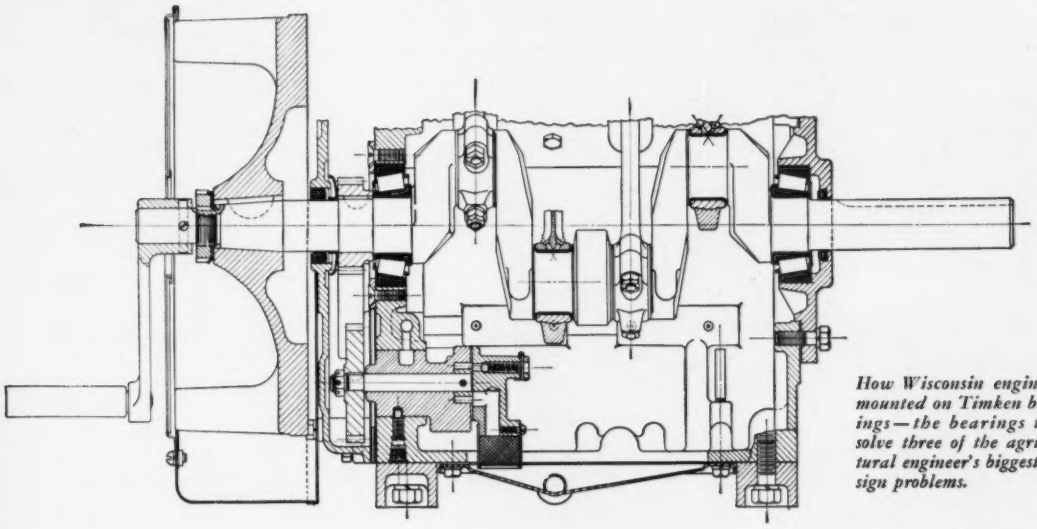

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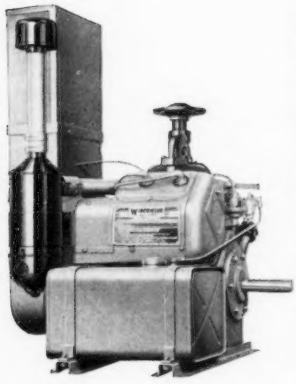

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